دراسة أولية لمشروع تصميم وتنفيذ نظام إرشاد ومراقبة وتحكم لمناطق زحام الحجيج في الأراضي المقدسة

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حج ١٤٢٣

١- مقدمة

بسم الله والحمد لله والصلاة والسلام علي معلم الناس الخير سيدنا محمد صلي الله عليه وسلم ومن اتبع هداه واستن بسنته إلي يوم الدين وبعد

إن مشكلة زحام الحجيج من المشاكل الهامة والتي تزداد صعوبة مع عدم التزام الحجيج بالإرشادات المكتوبة والمسموعة والمرئية وبما يعتقده البعض من شرف الموت في الأراضي المقدسة مما يشكل عبئا ثقيلا علي القائمين-رعاهم الله- من مصممي خطط التفويج والمنفذين لها ومع التقدم الهائل في وسائل تكنولوجيا المعلومات ومع ما تقدمه المملكة حفظها الله-ليس فقط من تسهيل خدمة الحجيج- ولكن الأخذ في الاعتبار ما ينشأ من أخطاء الحجيج نظرا لاختلاف الحضارات واللغات والثقافات التي يأتي منها كافة الحجيج فتقدم هذه الدراسة مشروع متكامل لتصميم وتنفيذ نظام ارشاد ومراقبة وتحكم عن طريق شبكة حاسبات موسعة آخذه في الاعتبار ما يلي:-

١- عدم التزام الحجيج بخطة التفويج الحالية

٢- عدم وضع بوابات حديدية والتي تزيد من مخاطر الزحام

٣- عدم الاعتماد علي الجانب البشري في تحديد عدد وكثافة الزحام في أي منطقة

٤- وجود مشكلة الافتراش التي تشكل اختناقا وتقليلا لمناطق المشاة المؤدية إلي جسر الجمرات

٥- عدم الالتزام بزيادة عدد ادوار جسر الجمرات

٢- فكرة المشروع

تعتبر مشكلة تدافع وزحام الحجيج من أكبر مشاكل أداء المناسك أيام الحج • وتتفاقم هذه المشكلة في منطقة رمي الجمرات وطواف الركن والوداع لمن أراد أن يتعجل ولا يعتمد الزحام في منطقة رمي الجمرات علي عدد الحجيج في هذه المنطقة وحدها ولكنه يعتمد علي المنطقة التي قبلها ، والمنطقة التي قبلها يعتمد الزحام فيها علي المنطقة التي قبلها حيث أن منظومة عدد الحجيج مترابطة ترابطا قويا حتي نصل إلي مزدلفة حيث يبيت أكثر الحجيج • ومن هنا تأتي فكرة المشروع وهو تصميم منظومة حاسبات مترابطة للمراقبة والتحكم والإرشا د في جميع مناطق أداء المناسك دون النظر إلي منطقتي رمي الجمرات ومنطقة الطواف وحدهما وتقترح هذه الدراسة تقسيم مناطق أداء المناسك إلي عدة مناطق • ويتم التحكم والمراقبة والإرشا د في كل منطقة علي حدة آخذة في الإعتبار الترابط القوي بين كل منطقة والمنطقة التي تليها حيث أن خرج عدد الحجيج من أي منطقة يعتبر دخلا للمنطقة التي تليها • وبناءا علي ذلك تقسم أيضا منطقة رمي الجمرات إلي أربع مناطق • منطقة قبل العقبة الصغري ومنطقة العقبة الصغري ومنطقة العقبة الوسطي ومنطقة العقبة الكبري • وتقسم بدورها المنطقة التي قبل العقبة الصغري إلي عدة مناطق • يتم المراقبة والتحكم والإرشا د في هذه قبل المناطق مجتمعة بواسطة شبكة حاسبات مترابطة حيث يقوم كل حاسوب تلقائيا علي حدة بالمراقبة والتحكم والإرشاد (عن طريق لوحة إرشاد) في منطقة ما ويرسل المعلومات المطلوبة إلي الحاسوب في المنطقة التي تليها ويتلقي المعلومات

المطلوبة من المنطقة التي تسبقها، وترتبط هذه الحاسوبات بحاسوب المراقبة والإرشاد الإنساني والذي له الأولوية في غرفة العمليات، ويتم التحكم في معدل التدفق الداخل لأي منطقة عن طريق دائرة من الجنود يحدد قطرها عن طريق خوارزم ذكي يرسل قيمة القطر إلي غرفة العمليت المركزية والتي بدورها ترسل غلي الجنود للإنتقال إلي الدائرة المناسبة والتي محددة في الأرض فينتقل الجنود من دائرة ذات قطر أصغر إلي قطر أكبر يحدده الخوارزم الذكي وذلك في حالة تقليل معدل التدفق الداخل ويتم العكس إذا كانت المنطقة غير مزدحمة

أ- تصميم شبكة الحاسبات المقترحة

بين شكل (١) خريطة منطقة أداء المناسك من مزدلفة حتى بداية العقبة الصغرى حيث يكون الرمي علوياً وسفلياً. ويبين أيضاً الشكل مقترح تقسيم المنطقة المشار إليها إلى عدة مناطق ويتحكم في عدد الحجيج في كل منطقة حاسوب خاص به ا
وهذا الحاسوب متصل بالحاسوب الذي قبله والحاسوب الذي بعده. والشبكة كلها متصلة بالحاسوب الموجود في غرفة العمليات . ويقوم كل حاسوب بحساب عدد الحجيج في كل منطقة وذلك بناء على قيمة الإشارة الداخلة له من عدة كاميرات توضع في المنطقة المراد التحكم في عدد حجيجها

ب- التحكم المنطقي اللفظي في عدد حجيج كل منطقة

هذا التحكم هو من نوع التحكم المغلق ، حيث يقوم الحاسوب بحساب العدد الفعلي للحجيج في المنطقة (وذلك بناء على قيمة إشارات الكاميرات) وباعتبار أن نصف متر مربعاً مساحة

ملائمة لتلافي الزحام والتدافع وبناء على مساحة المنطقة يتم حساب العدد المرغوب للحجيج في هذه المنطقة . ويقوم الحاسوب بحساب الفرق بين القيمة الفعلية لعدد الحجيج والقيمة المرغوبة ويمكن بالطبع حساب أيضاً معدل تغير هذا الفرق حيث يستخدم هذا المعدل في تحسين أداء دائرة التحكم المغلقة . يقوم خوارزم التحكم اللفظي بناءاً على قيمة الخطأ وكذلك على قواعد (إذا ... إفعل) علي اختيار قطر دائرة الجنود • كما يبين ذلك شكل(٢)

٣- امكانية التطبيق

في المراجع المشار إليها في نهاية الملحق العلمي نجد أن نظام تحديد عدد وكثافة الأشخاص في مناطق مزدحمة تماثل منطقة جسر الجمرات مثل مترو الأنفاق في هونج كونج والذي يرتاده يوميا ٣و ٢ مليون شخص يوميا قد تم بوسطة نفس النظام المقترح من كاميرا وحاسوب وكذلك في لندن

٤- الخطوة التالية

تقديم عرض للمشروع المقترح عند متخذي القرار لتكوين قناعة لديهم بامكانية المشروع والإجابة علي كافة التساؤلات وتحديد الخطوات التالية علي ضوء هذا العرض

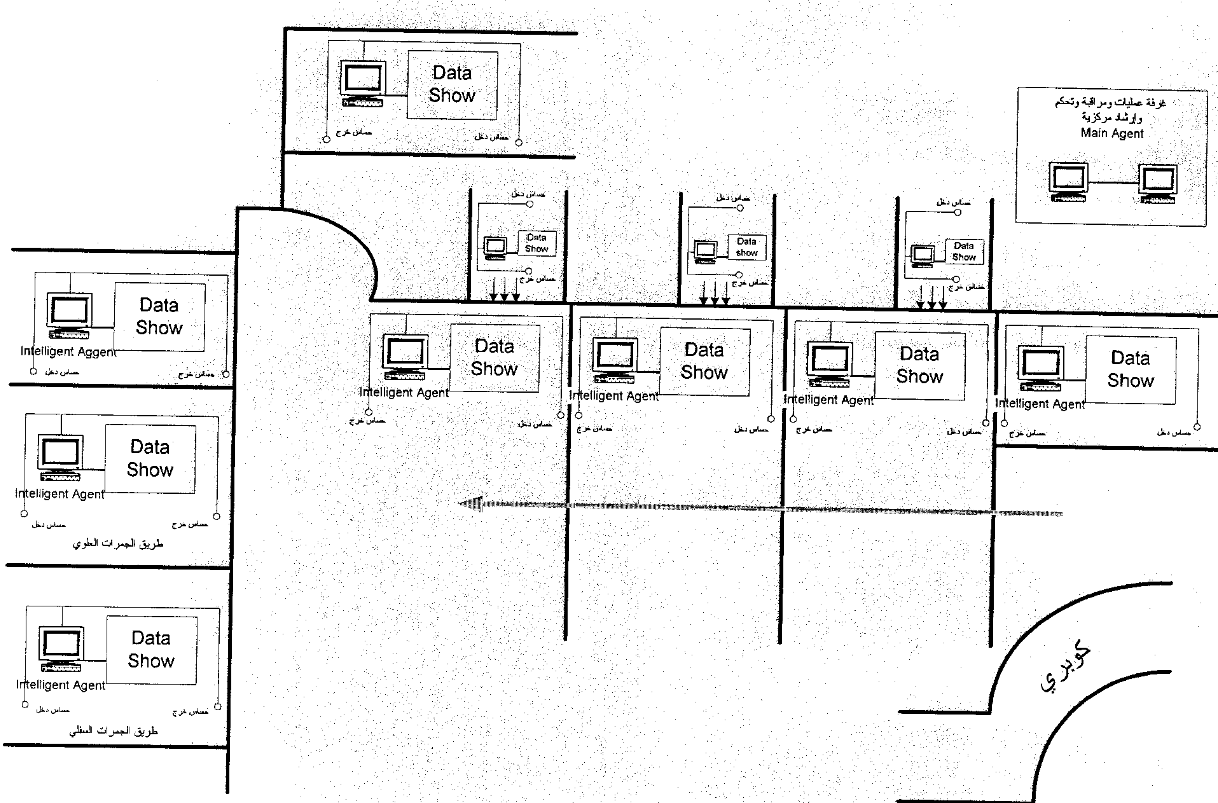


Fig (1): SCADA system overview

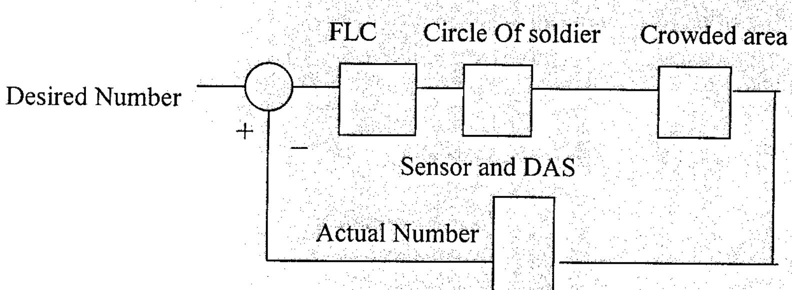


Fig (2): Proposed Closed Loop System

MONITORING, SURVEILLANCE and CONTROL of the CROWDS in the HOLY SITES USING SCADA SYSTEM

Technical Report No 2

Contents:

1.Problem Description (Revised)

The management and control of crowds is a crucial problem for Human Life and Safety [1]. In order to carry out such task, there is an established practice of using extensive closed-circuit television system. However, the large number of video cameras often used by such systems requires a huge recording and storage capacity and a number of people to observe the television monitors. As routine monitoring is tedious, the observers are likely to lose concentration. The advantages and necessity of the automatic surveillance for routine crowed monitoring and controlling are, therefore, clear.

2.SCADA System Overview

The management and control of crowds in consecutive areas are a highly coupled system. In Jamarat bridge, for example, the number of people who enters the smallest Jamra is proportional to the number of people who enters the Jamarat bridge. And the number of people who enters the Jamarat bridge is proportional to the number of people who comes from the different street and areas, which communicate the Jamarat bridge with the Mena city. To manage and control the crowds, the total area, which consists of the Jamarat bridge and the entrance of the bridge, are divided to consecutive areas. Each area is to be controlled with a closed loop system to manage and control the crowds in such area. Fig (1) gives the SCADA system overview.

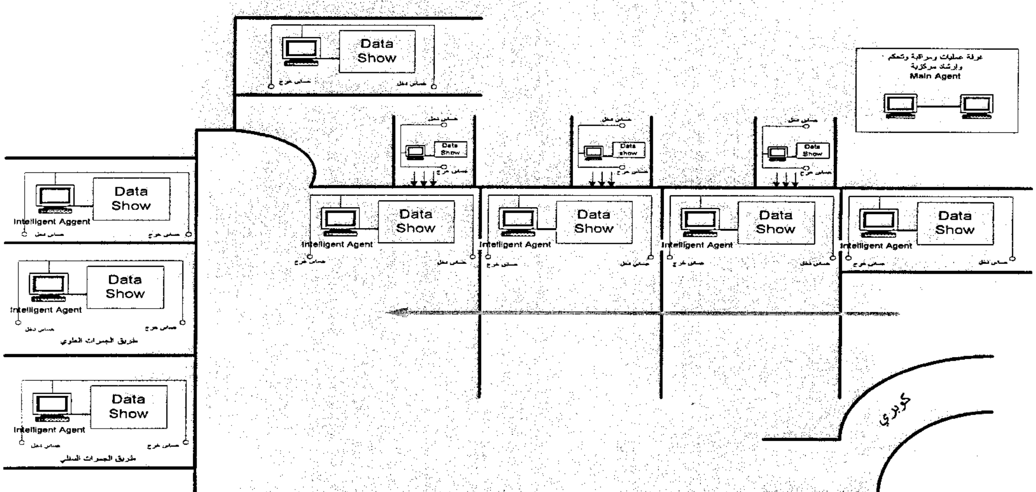


Fig (1): SCADA system overview

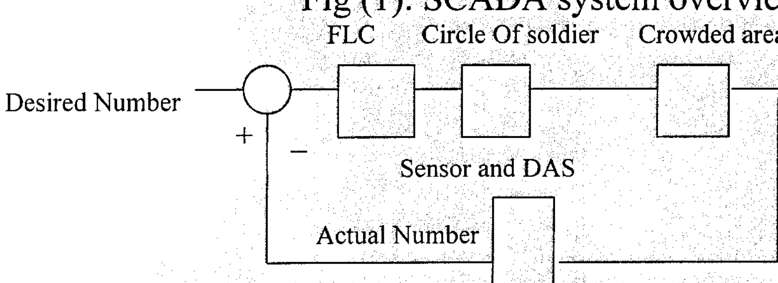


Fig (2): Proposed Closed Loop System

3.Problems

In trying to automate the mentioned surveillance, many problems arise.
What is the appropriate sensor and data acquisition system, which can be used in real time monitoring and control? What is the appropriate S/W algorithm to estimate crowed density? , What is the dynamic model of the flow of large crowd of pedestrians?
The last question is necessary to dynamically simulate the large crowds of pedestrians, as well as, the suggested control algorithm, and in finally to simulate the overall system with all kinds of the scenarios which contain all types of the possible disasters. By such simulation, the predicted disasters can be avoided.
What is the appropriate actuator to implement the control algorithm?

4.Crowd Monitoring Sensors

In general, to detect the number of the people, there are many ideas of detectors [2]. Some types require contact with people, which obstruct the path. From these types, e.g., are turnstiles and mat-type foot switches. The above sensors are suitable only for counting a few people and are not adequate for crowd monitoring. On the other hand, there are non-contact and non-obstruct sensors. From these types, are CCD visual camera, the IR sensor and the ultrasonic sensors Ultrasonic sensors are widely used for industrial application to measure both object distance in the atmosphere and flow velocity. Ultrasonic waves are much slower than microwaves. The last two types are not also adequate for crowed monitoring. In [2], a mole-element IR sensor made of piezoelectric pbtio3 ceramics is development. There is a trial in [3] to use much like the last sensor for crowed monitoring. To the anthers's knowledge, there are some problems associated with the mentioned thermal imager, due to the high temperature environment in the holy sites (i.e. Mena and Mecca).

Recently, three real-time crowd density estimation systems in London [4], Geneva [5] and Hong Kong [6], were proposed based on their existing CCTV. Fig (3) illustrates such system [7]. The video images are digitized at a resolution of 512x512 pixels and 256 grey levels. As shown a standard domestic camera (camcorder) is used to record scenes in a site of interest. The recording are digitized and processed under the control of a standard workstation (pc or sun). Section 6 proposes a digital CCD camera with the associated H/W and S/W.

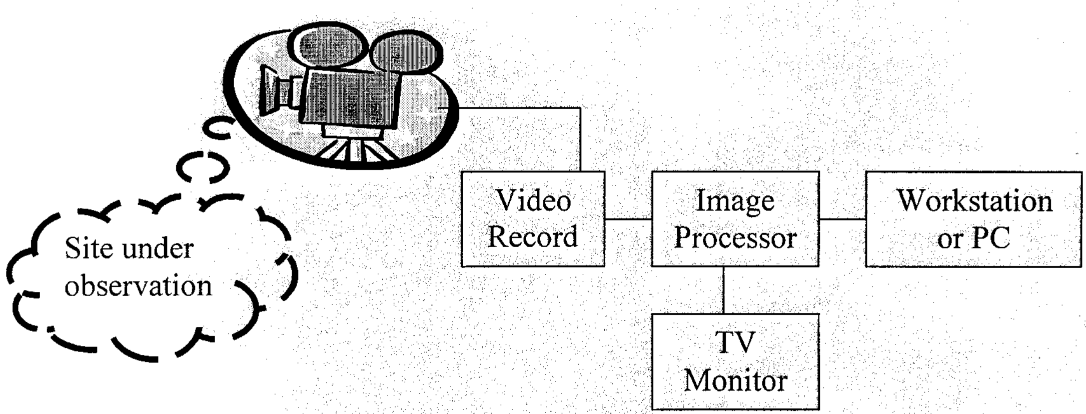


Fig (3): Recording Process of SCADA

5. Techniques for Crowd Density Estimation

In general, there are different techniques for object detection .The philosophy of these techniques is to isolate the object from the background on a single frame or sequence of frames [11]. Some of these techniques are investigated in the following subsections.

5.1 Threshold.

This is one of the simplest, but less effective techniques which operates on still images. It is based on the notion that having different intensities from their background. Adaptive threshold can be used for account for lighting changes, but cannot avoid the false detection of parts of the object with similar intensities as its environment.

5.2 Edge-based detection (spatial differentiation)

Approaches in this class are based on the edge-feature of the object. Morphological edge-detection schemes have been extensively applied, since they exhibit superior performance. Histogram analysis can be used to identify the object. Edge-based detection is often more efficient than background removed or threshold approaches, since the edge information remains significant even in variations of ambient lighting.

5.3 BACKGROUND FRAME DIFFERENCING

This method is based on forming a precise background image and using it for separating moving object from their background. The background can change significantly with shadows cast by building and conditions. Adaptive background should be used to overcome the mentioned problems. However, all the above technique can only be used in counting few pedestrians and are not adequate for crowd estimation. The next technique is adequate for crowd estimation [1, 4, 5, 9].

The first technique for crowd density estimation is proposed by Davies [9] to estimate crowd densities extracts two measures from the input image of the area being analyzed. The first measure computes the number of foreground picture elements while the second one computes the number of edge picture elements present in the image. The foreground picture elements are obtained by subtracting the input image from a reference image containing no people. The edge picture elements are obtained by edge detection, followed by a thinning operation. Mat lab simulation is used to count the prayers, using the above algorithm. The result is illustrated in section 6. In addition to the two measurements, it was verified that there exists a linear relationship between the numbers of people and the number of picture elements measured in the input image. Therefore, it was possible to combine these two measurements into an optimal estimation of the crowd density through a linear Kalman filter. Despite the success of this technique for estimating crowd density in areas containing a few people, it can not be applied successfully for areas with high density crowds. This is because the linear relationship between the real number of people in the area and the number of pictures and edges elements measured in the image does not hold when there are many overlapped people in the image. To overcome the above problem, technique for crowd density estimation based on texture analysis is used [5].

5.4 Space signature.

In this detection method, the object to be identified (pedestrians) is described by their characteristics (form, dimensions, luminosity) which allow identification in their environment. Space signatures can also be identified in an image through correlation or template matching technique. Due to the inflexible nature of template matching, a specific template must be created for each type of objects to be recognized

6. Extraction of Image Features Using Textures Analysis

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The basic idea of such technique is that, images of crowds with different densities tend to present different texture patterns. An image of high density crowded area is often made up of fine (high frequency) patterns, while an image of low density crowded area is mostly made up of coarse (low frequency) patterns, especially when the background is also of low frequency. The estimation of crowd densities is based on texture measures of the image and is given in terms of ranges such as very low, low, moderate, high, and very high densities. The number of people for each range depends on the particular characteristics of the area being monitored. Fig (4) shows how images have been used in the above technique to estimate the number of people in the area under surveillance.

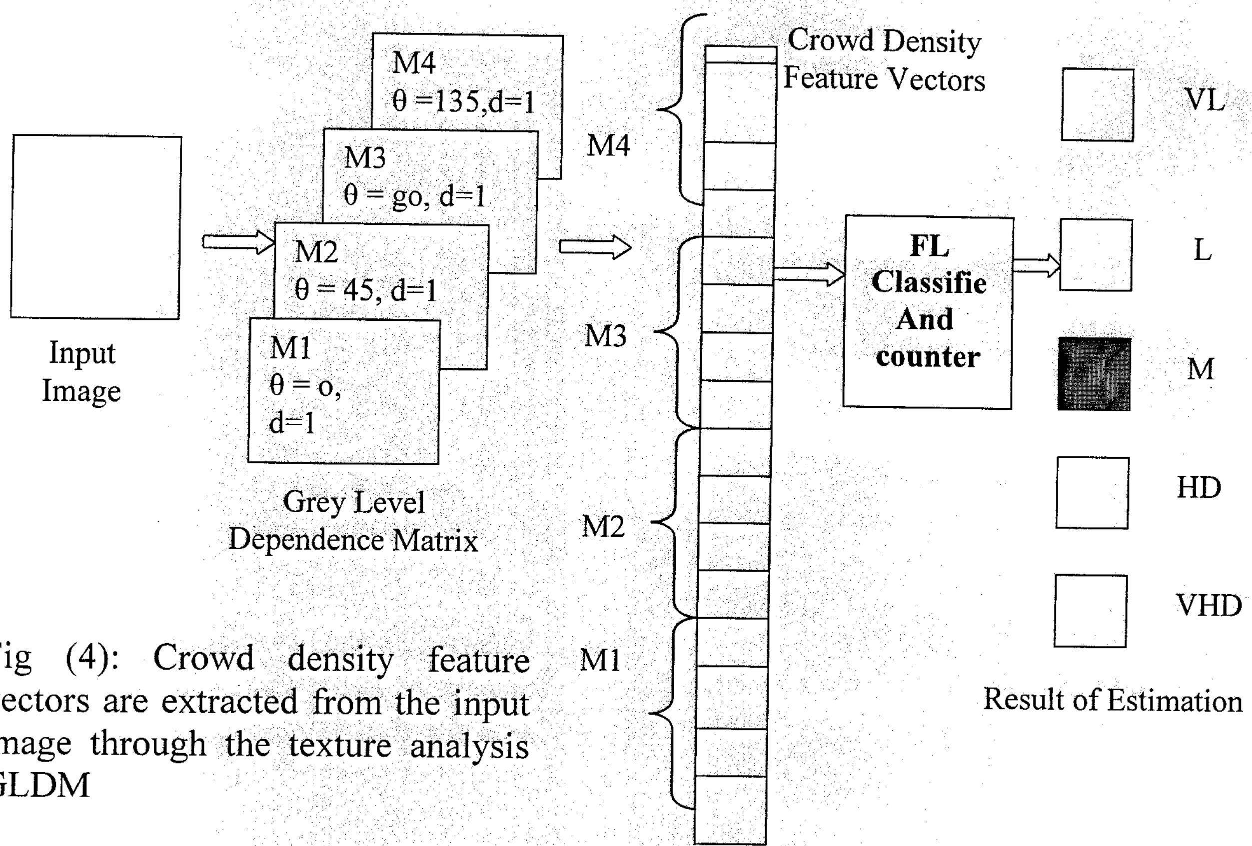


Fig (4): Crowd density feature vectors are extracted from the input image through the texture analysis GLDM

The fist step of technique consists in to calculate measures of contrast, homogeneity, energy and entropy for four grey level dependence matrices, which are obtained by applying the GLDM method on the input image with $(d,\theta)=(1,0^{\circ}), (1, 45^{\circ}), (1, 90^{\circ})$ and $(1, 135^{\circ})$.
The grey level dependence matrix method proposal by Haralick [14] is based on the estimation of second order joint conditional probability density function $f(i,j/d,\theta)$. Each $f(i,j/d,\theta)$ is the probability of pair of grey level (i, j) occurring in pair of pixels of the image given that these pixels are separated by a distance d along direction θ. The estimated values from a two-dimensional histogram which can be written in matrix form, the so-called grey level dependence matrix (GLDM).
Because GLDM must be estimated for each pair of parameters (d, θ), it is usually computationally necessary to restrict these parameters to a limited number of values, i.e. $(0^{\circ},45^{\circ},90^{\circ},135^{\circ})$ and d is only one pixel. For a given pair (d, θ), the histogram obtained for fine texture tends to be more uniformly dispersed than the histogram for course texture. Texture coarseness can be measured in terms relative spread in histogram occupancy cells about the main diagonal of histogram. Only for of the spread indicators proposed by Haralick for texture measurements have been used:

Contrast: $$S_c(d,\theta) = \sum_{l=0}^{L-1} \sum_{j=0}^{l-1} (i-j)^2 f(i,j/d,\theta)^2 \quad (4.1)$$

Homogeneity: $$S_h(d,\theta) = \sum_{l=0}^{L-1} \sum_{j=0}^{l-1} \frac{f(i,j/d,\theta)}{1+(i-j)} \quad (4.2)$$

Energy: $$S_g(d,\theta) = \sum_{l=0}^{L-1} \sum_{j=0}^{l-1} f(i,j/d,\theta)^2 \quad (4.3)$$

Entropy: $$S_p(d,\theta) = \sum_{l=0}^{L-1} \sum_{j=0}^{l-1} f(i,j/d,\theta) \log f(i,j/d,\theta) \quad (4.4)$$

Where L is the number of grey level of the image.

The 16 measurements obtained from $(d,\theta)=(1,0^0)$, $(1,45^0)$, $(1,90^0)$ and $(1,135^0)$, are put into a vector, which is used as the crowed density feature vector of the image. This feature vector is used by SOM neural network to estimate the range of crowed density. The range of density is estimated as one of the five possibilities as the process of estimation of crowed density is supervised., it requires a previous stage where the neural network is trained. There for, it is necessary to collect the image from the area of monitoring to be used on the training set of images for the neural network. Such a set must included enough number of samples for each one of the pre defined ranges of crowed densities in order to be statically significant.

7.Model Of Jamarat Bridge

In fact the two references [23, 24] give an excellent model of flow of pilgrims over the Jamrat bridge. The purpose of this section is only to emphasis on the existing of such model, as well as, the importance of using such model in simulation of the whole proposed SCADA system which will be given in feature work.

The model derived by R.L. Hughes is based on the assumption that the flow of pilgrims at very high density, is fluid analogy. The continuity equation is then used. The equation follows simply by equating the net flow of pedestrians into a small region to the time rate of accumulation of pedestrians in the region, and letting the area of the region shrink to zero.

The pedestrian flow is given in terms of two qualities. These qualities are;

(I) density, ρ, of the flow, which is expected number of individuals located within unit area of floor space at the given time, t, and location (x, y) e.g.

(II) velocity, (u, v) of the flow, which is expected velocity of individuals at a given time, t, and location (x, y), e.g. (0.1, 0.5)m/s
Thus, conservation of pedestrians implies the continuity equations

$$\frac{\partial\rho}{\partial t}+\frac{\partial}{\partial x}(fu)+\frac{\partial}{\partial y}(fv)=0 \qquad (5.1)$$

Several hypothesis are assumed to give the following governing equation for pedestrian flow.

$$-\frac{\partial\rho}{\partial t}+\frac{\partial}{\partial x}\left(\rho g(\rho)f^2(\rho)\frac{\partial q}{\partial x}\right)+\frac{\partial}{\partial y}\left(\rho g(\rho)f^2(\rho)\frac{\partial q}{\partial y}\right)=0 \qquad (5.2)$$

and $$g(\rho)f(\rho)=\frac{1}{\sqrt{\left(\frac{\partial q}{\partial x}\right)^2+\left(\frac{\partial q}{\partial y}\right)^{2}}} \qquad (5.3)$$

where q is the Potential. Observations of pedestrian motion suggest that $f(\rho)$ and $g(\rho)$ can be approximated by

$$f(\rho)=\begin{cases} A & \rho\le\rho\ \text{trans} \\ A\sqrt{\frac{\rho trans}{\ell}} & \rho\ \text{trans}\ <\rho\le\rho\ \text{crit} \\ A\sqrt{\frac{\rho trans\,\rho crit(\rho\max-\rho)}{\rho^2(\rho\max-\rho crit)}} & \rho crit<\ell\le\rho\max \end{cases} \qquad (5.4)$$

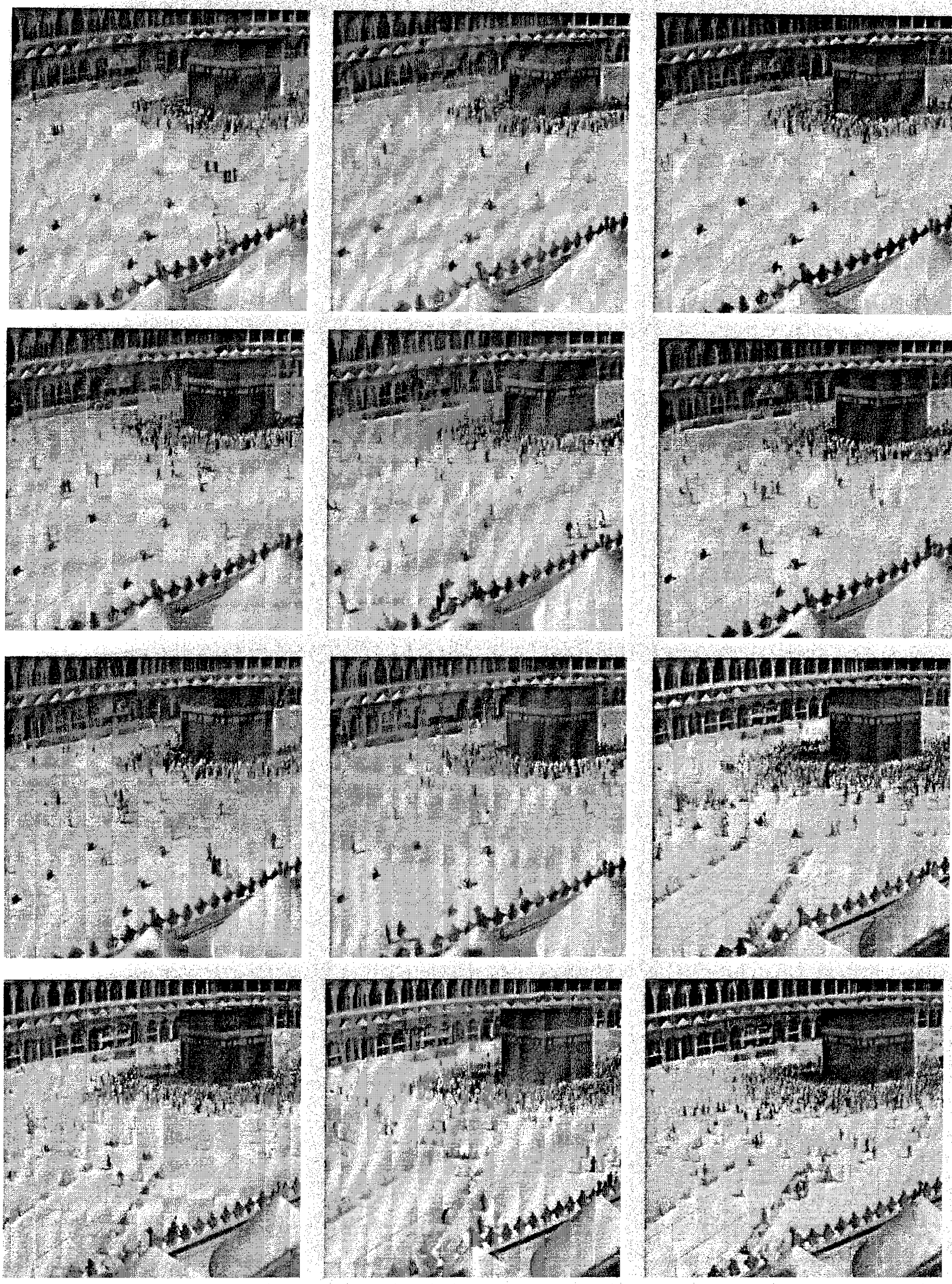
And

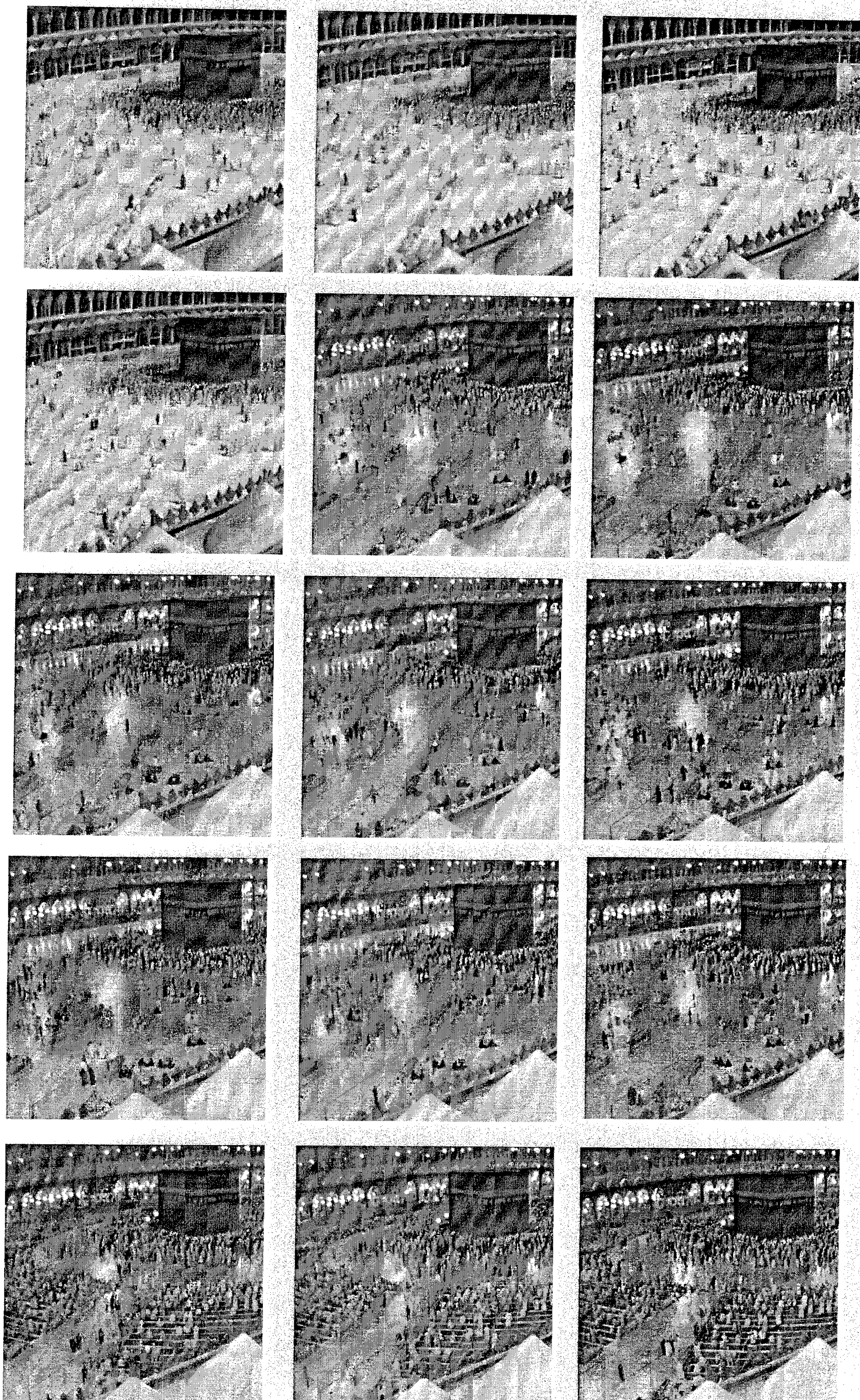
$$g(\rho)=\begin{cases} 1 & \rho\le\rho\ \text{crit} \\ \frac{\rho(\rho\max-\rho crit)}{\rho crit(\rho\max-\rho)} & \rho crit<\rho\le\rho\max \end{cases} \qquad (5.5)$$

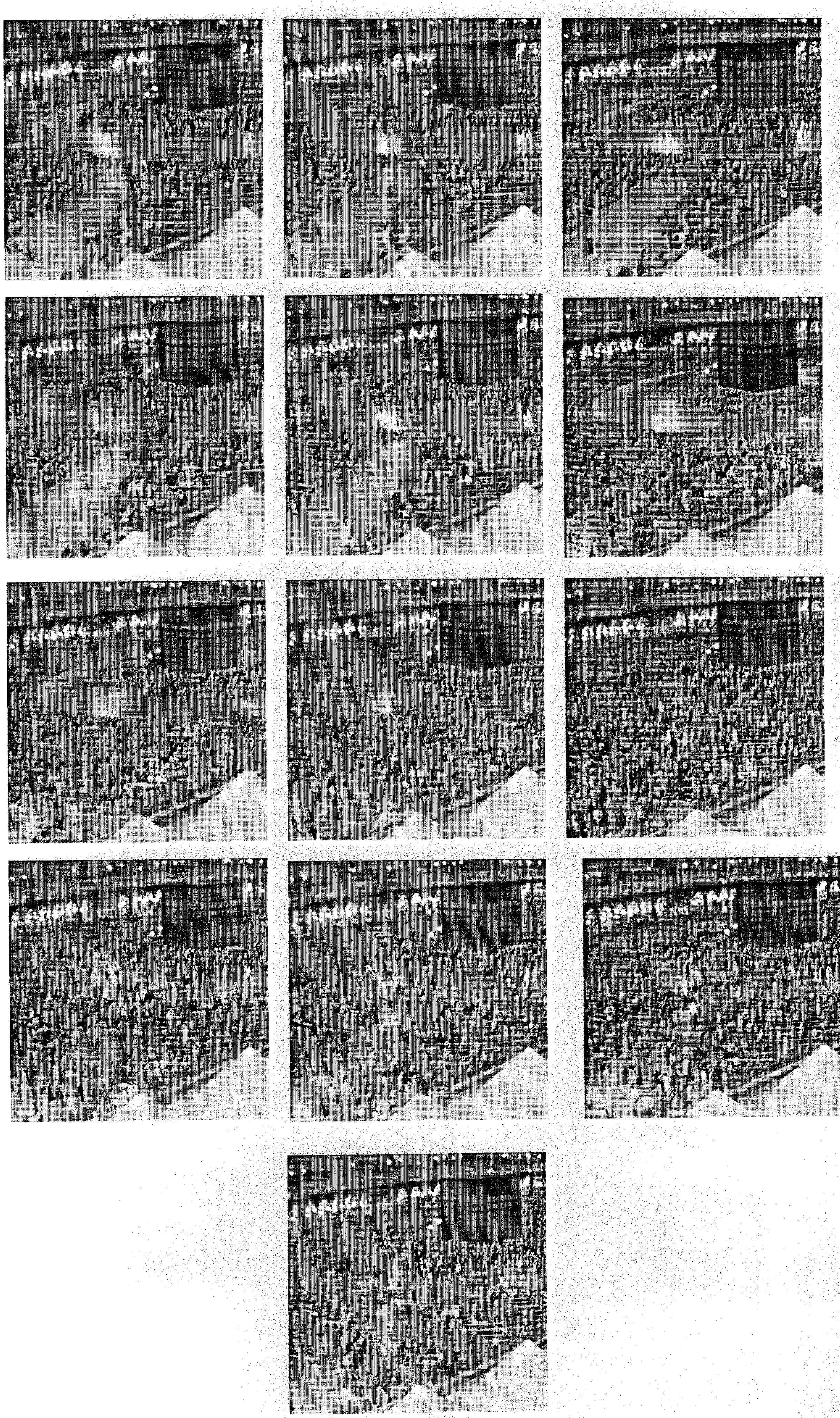
When $A=1.4\ ms^{-1}$, ρ trans $=0.8\ m^{-2}$
ρcrit $= 3m^{-2}$ and $\rho\max = 5m^{-2}$ Typically.
The flow of pedestrian per unit width, F, is related to the density of the flow by
$F=\rho\ f(\rho)$ (5.6)
The solution of the equation is compared with the result obtained by Selim and Al-Rabeh's model. The last model (i,e given by Selim and Al Rabeah) shows that the density can reach above 4/m2 at pillar location. This is happen in normal case. The advantage and necessity of closed loop control system are, therefore clear. Dynamic Simulation with the proposed FLC will be given in another future work.

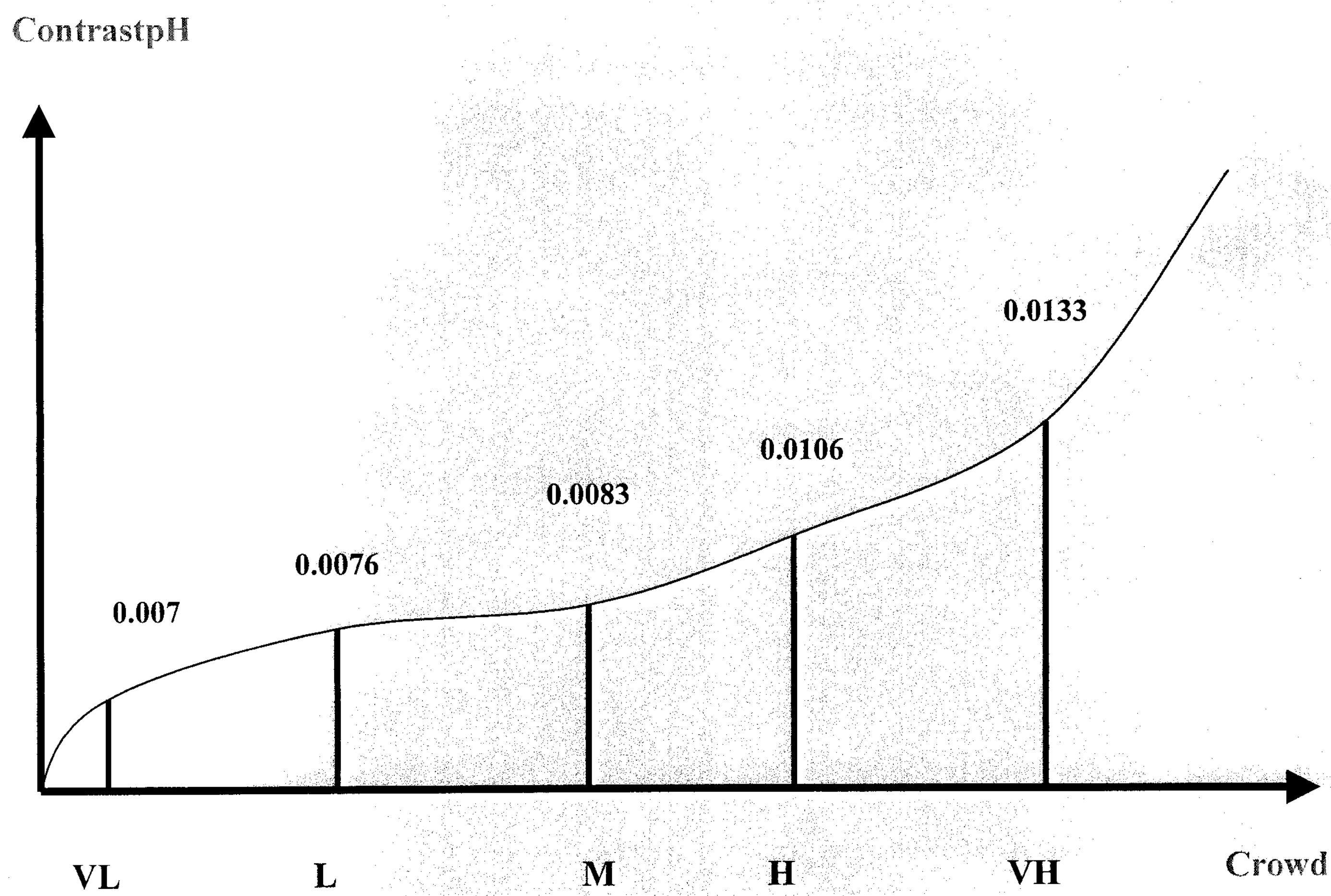
9. Simulated Results

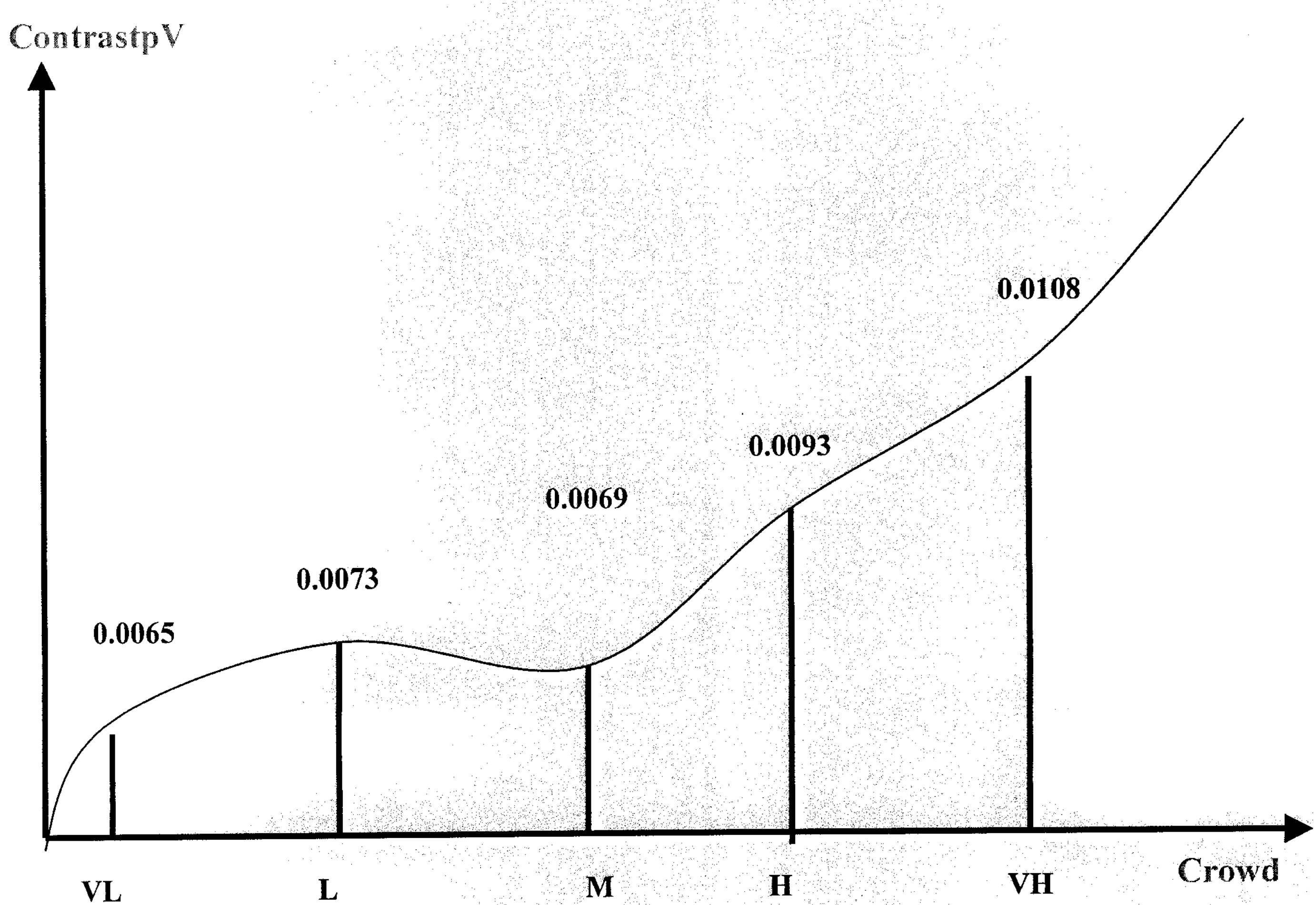
The crowded images are classified according to the density of crowding (i.e very low , low , medium ,high , very high) .The texture analysis using the above algorithm is applied . The following simulated results with the associated images are given .

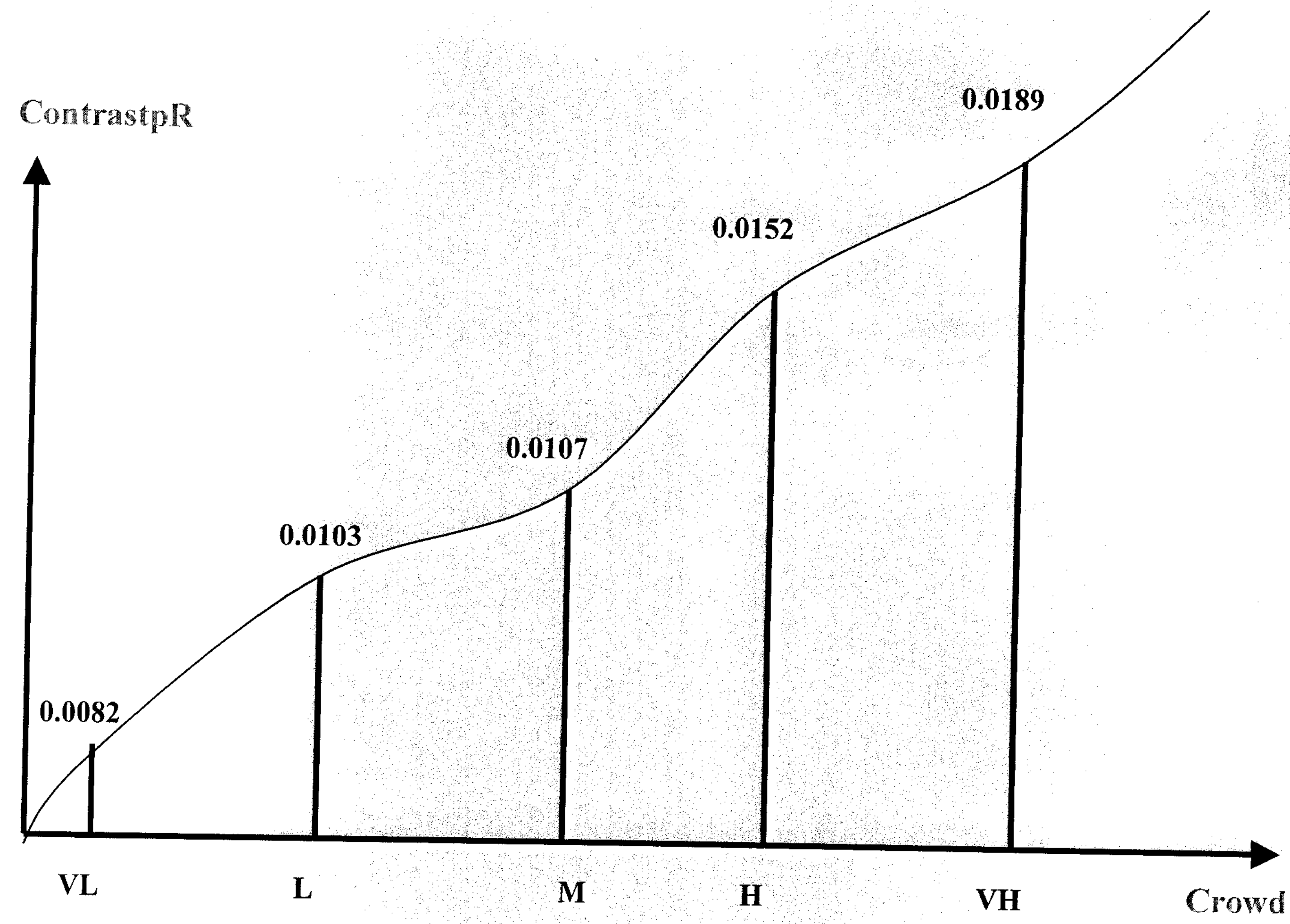


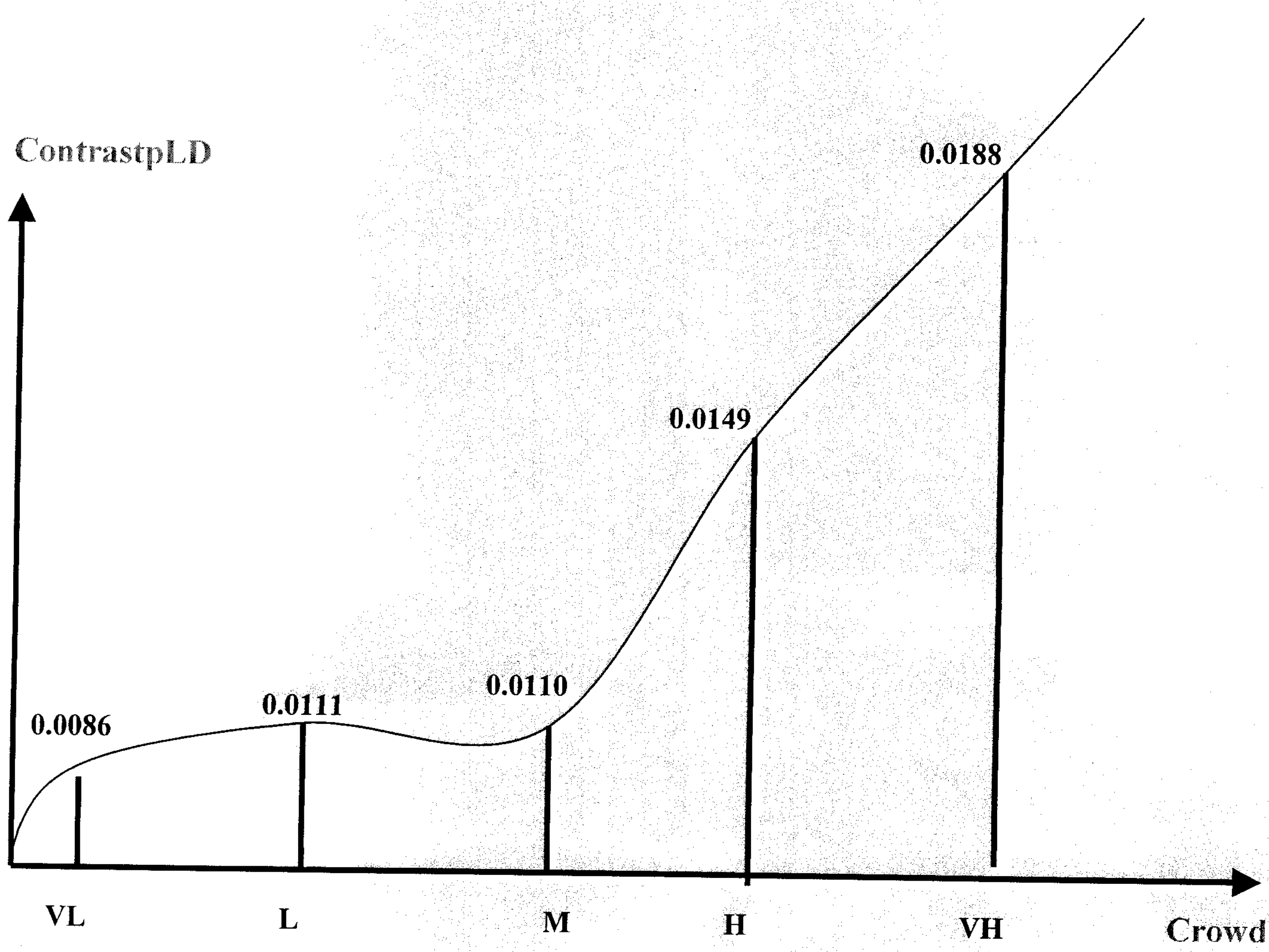


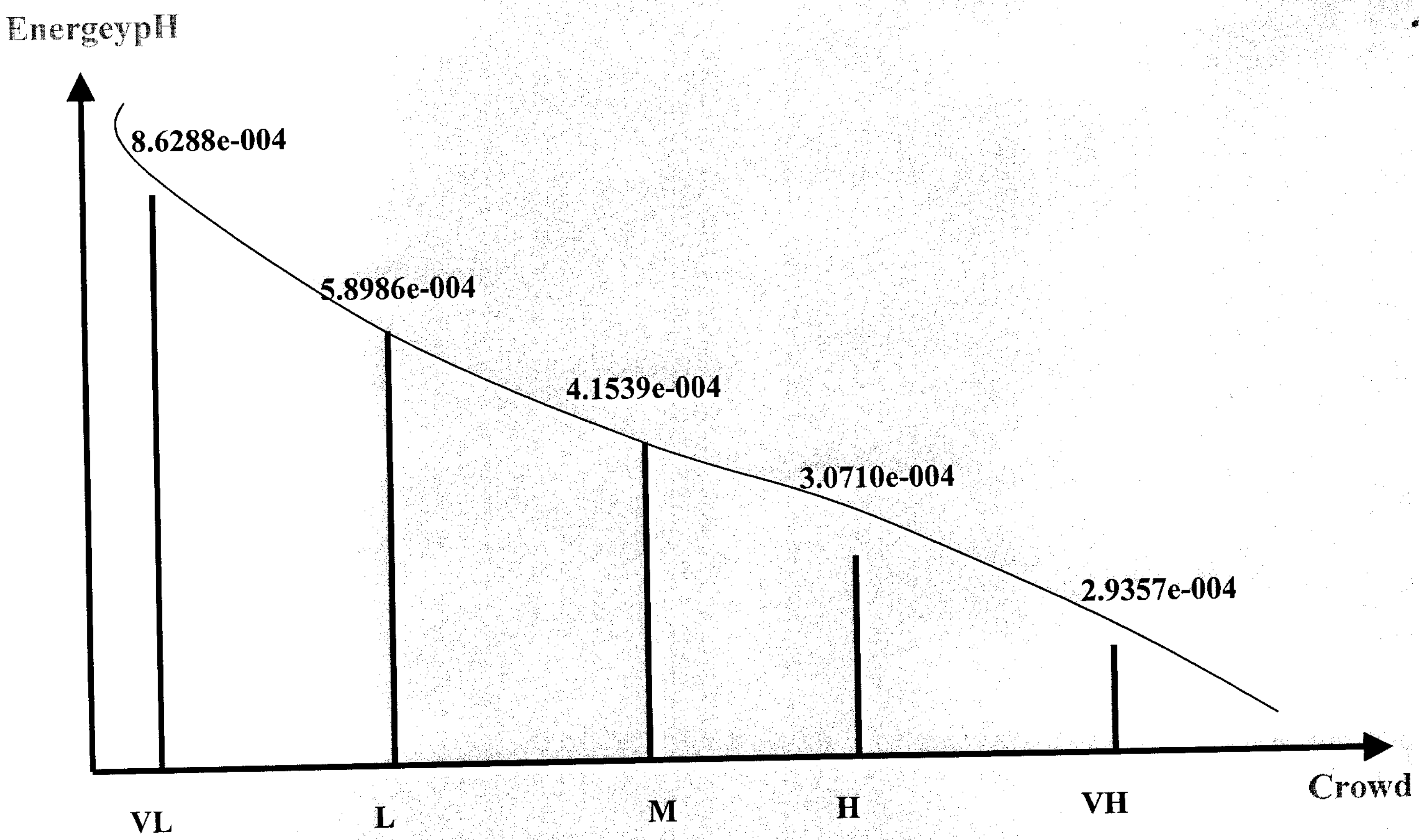


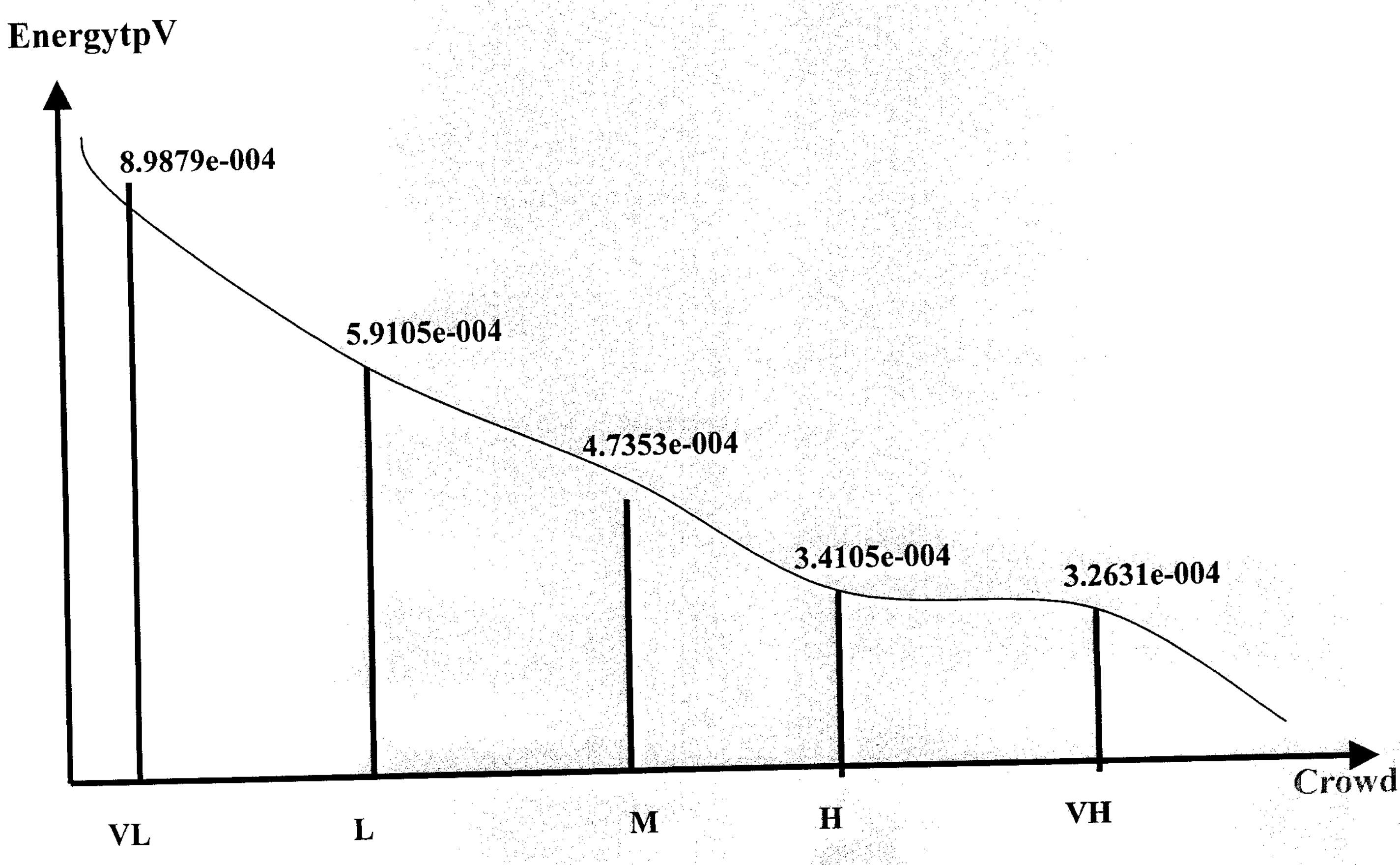

ContrastpH
0.007
0.0076
0.0083
0.0106
0.0133
VL
L
M
H
VH
Crowd

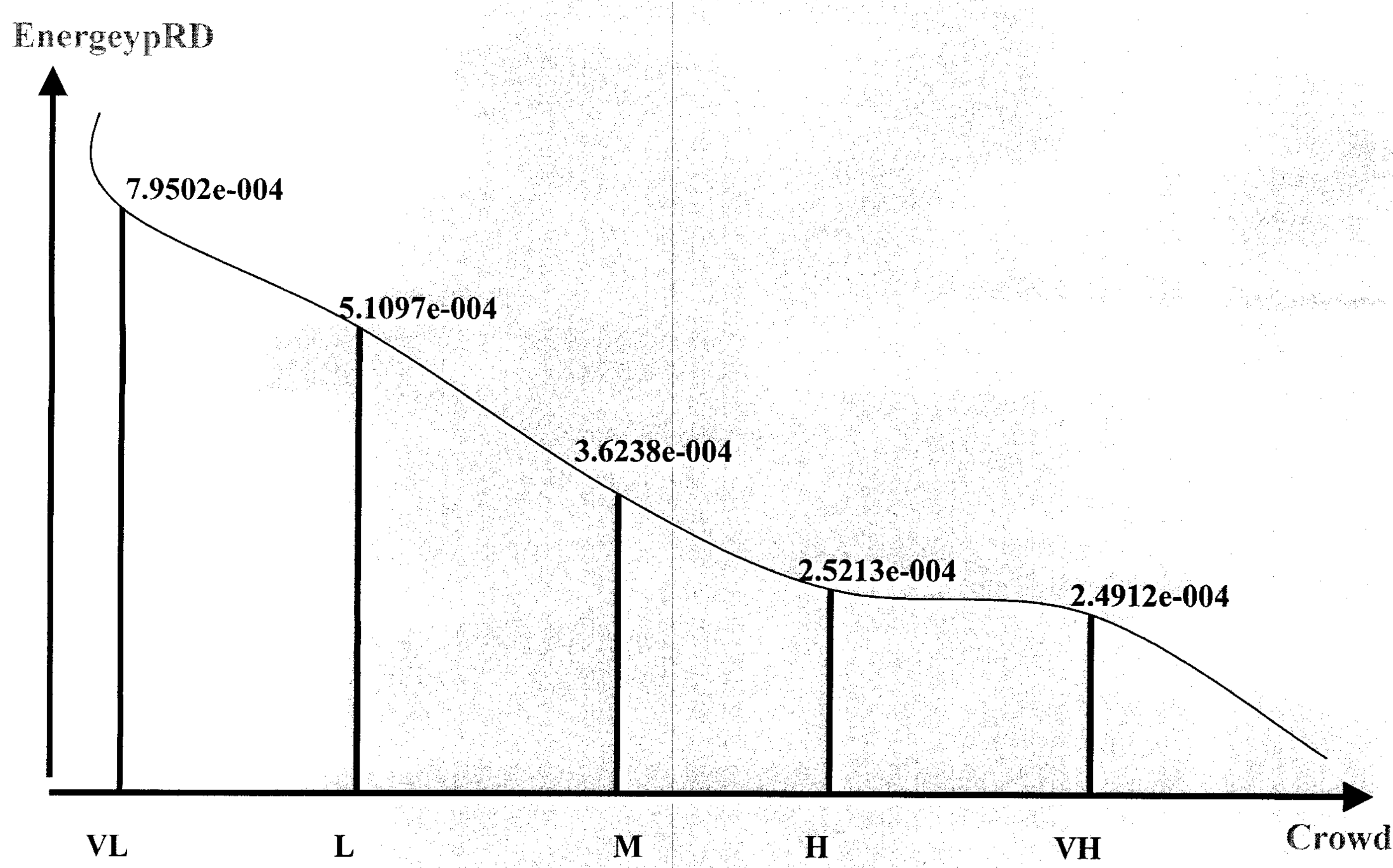

ContrastpV
0.0065
0.0073
0.0069
0.0093
0.0108
VL
L
M
H
VH
Crowd

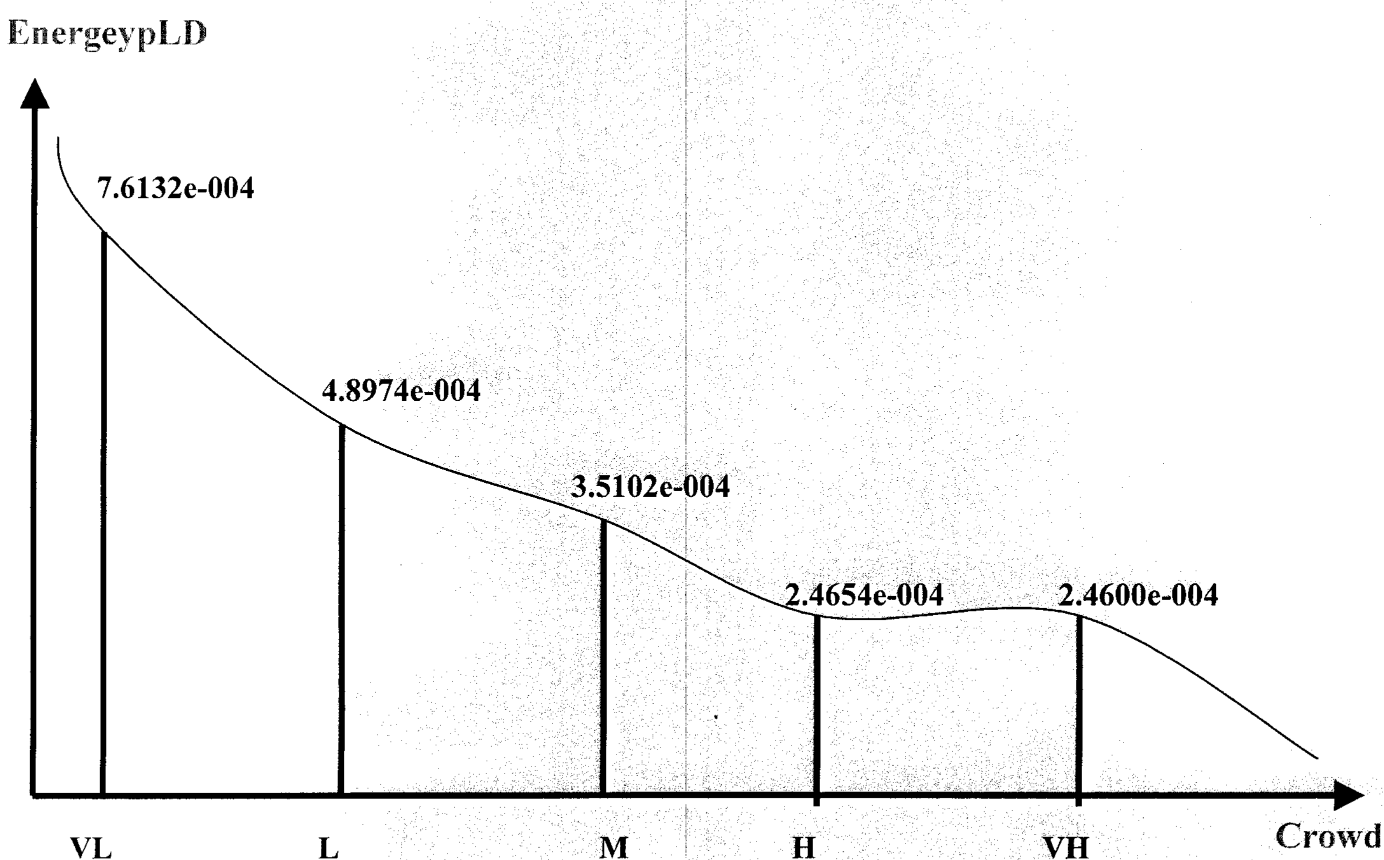

ContrastpR
0.0189
0.0152
0.0107
0.0103
0.0082
VL
L
M
H
VH
Crowd

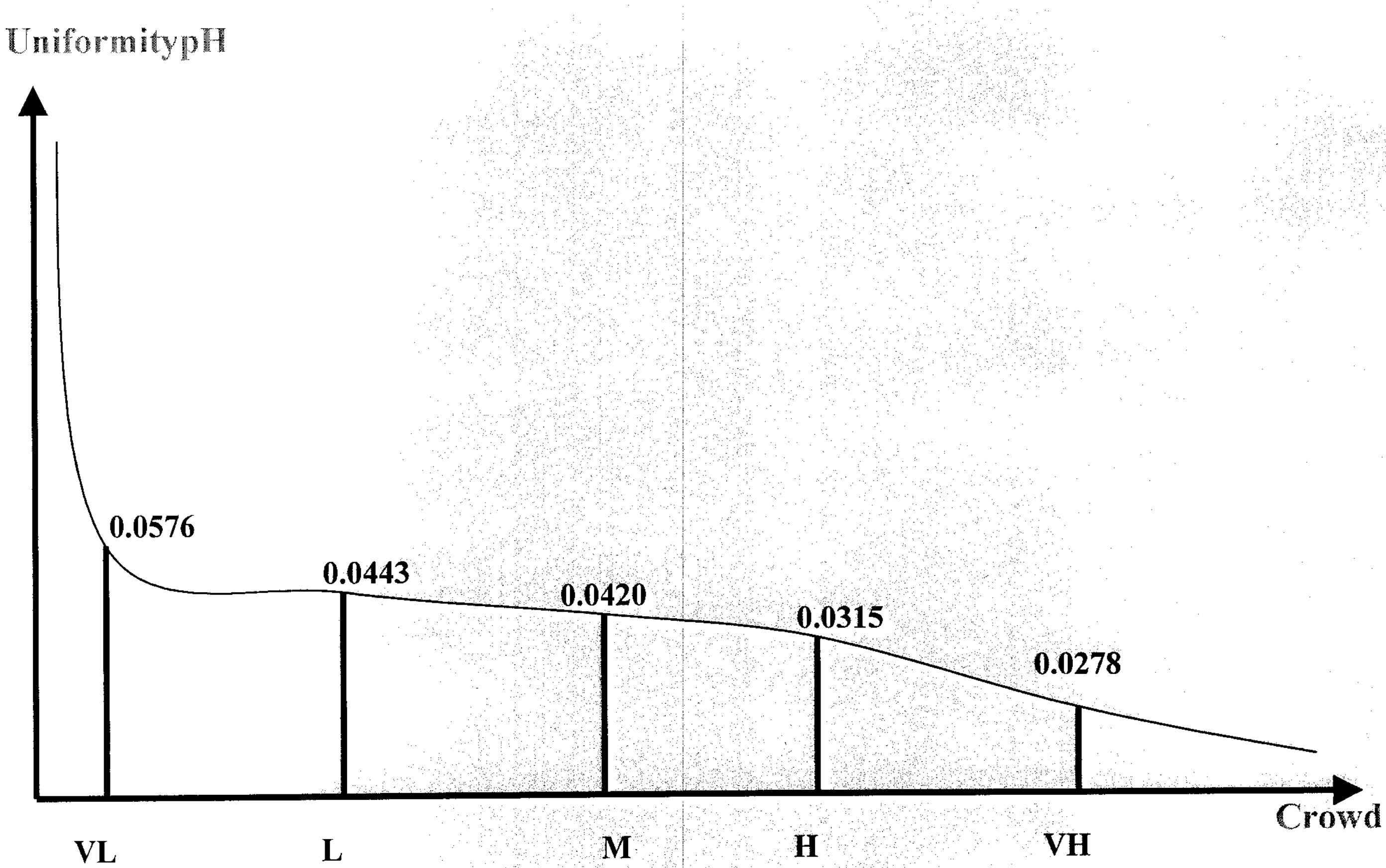

ContrastpLD
0.0188
0.0149
0.0110
0.0111
0.0086
VL
L
M
H
VH
Crowd

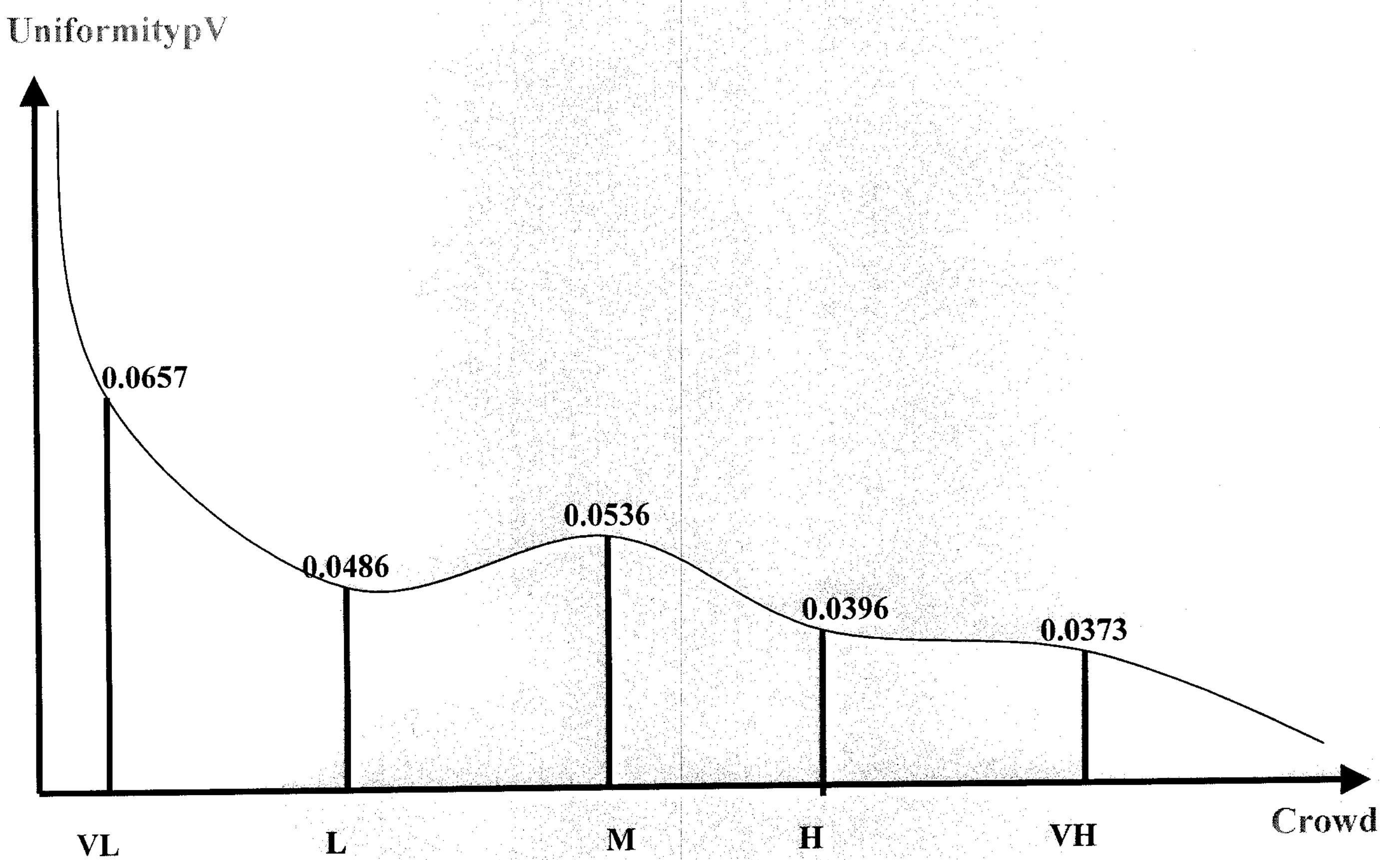

EnergeypH
8.6288e-004
5.8986e-004
4.1539e-004
3.0710e-004
2.9357e-004
Crowd
VL
L
M
H
VH

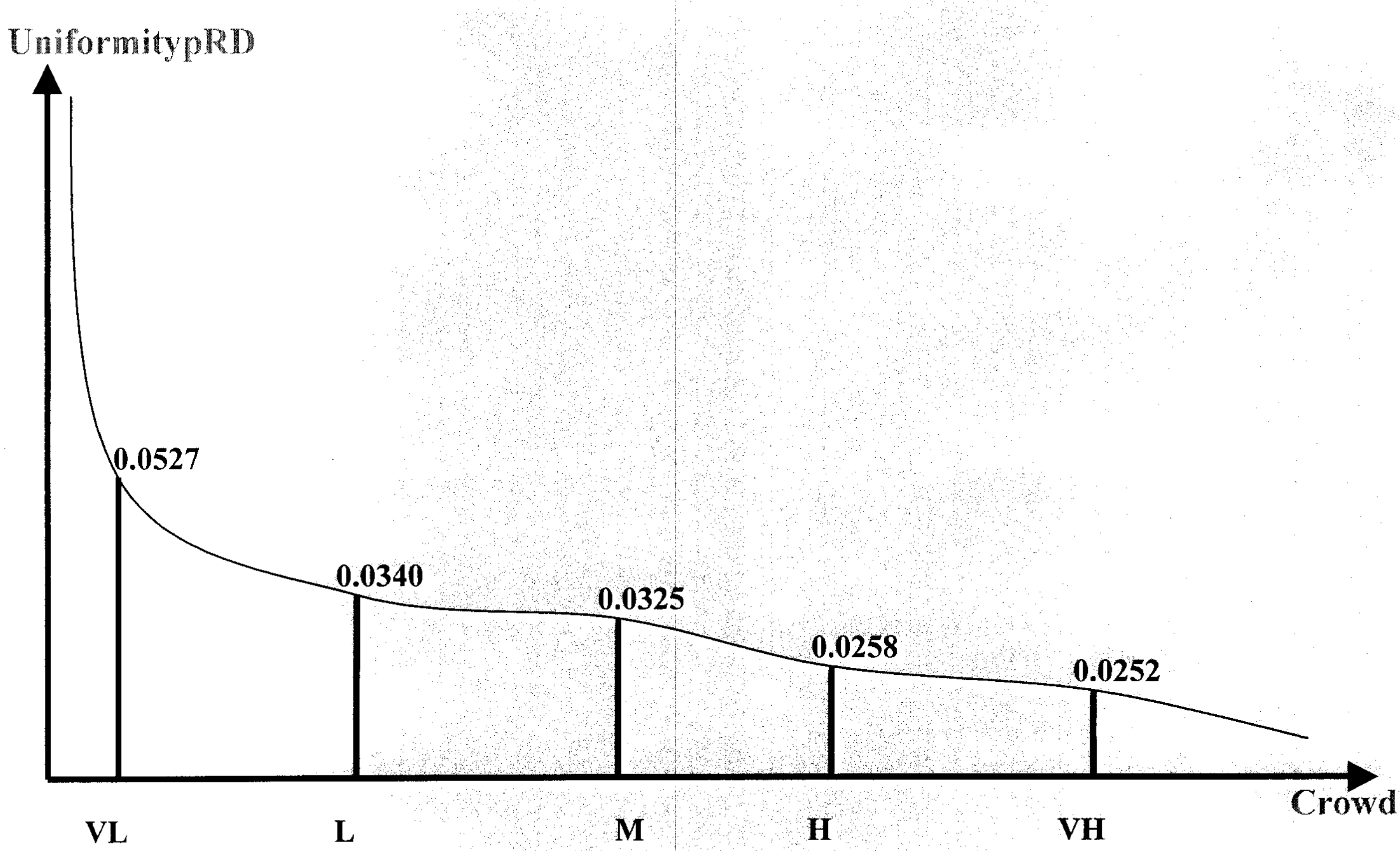

EnergytpV
8.9879e-004
5.9105e-004
4.7353e-004
3.4105e-004
3.2631e-004
Crowd
VL
L
M
H
VH

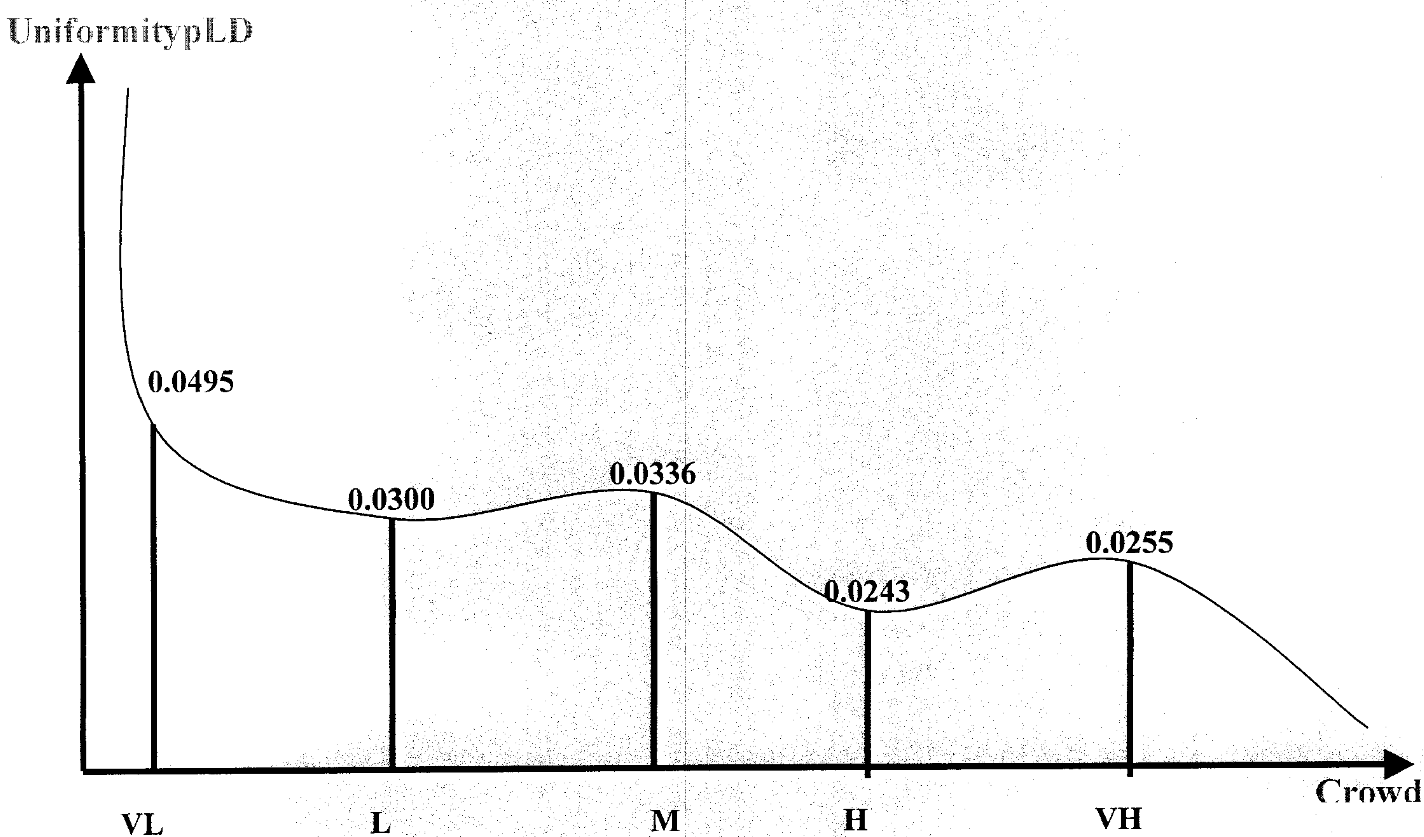

EnergeypRD
7.9502e-004
5.1097e-004
3.6238e-004
2.5213e-004
2.4912e-004
VL
L
M
H
VH
Crowd

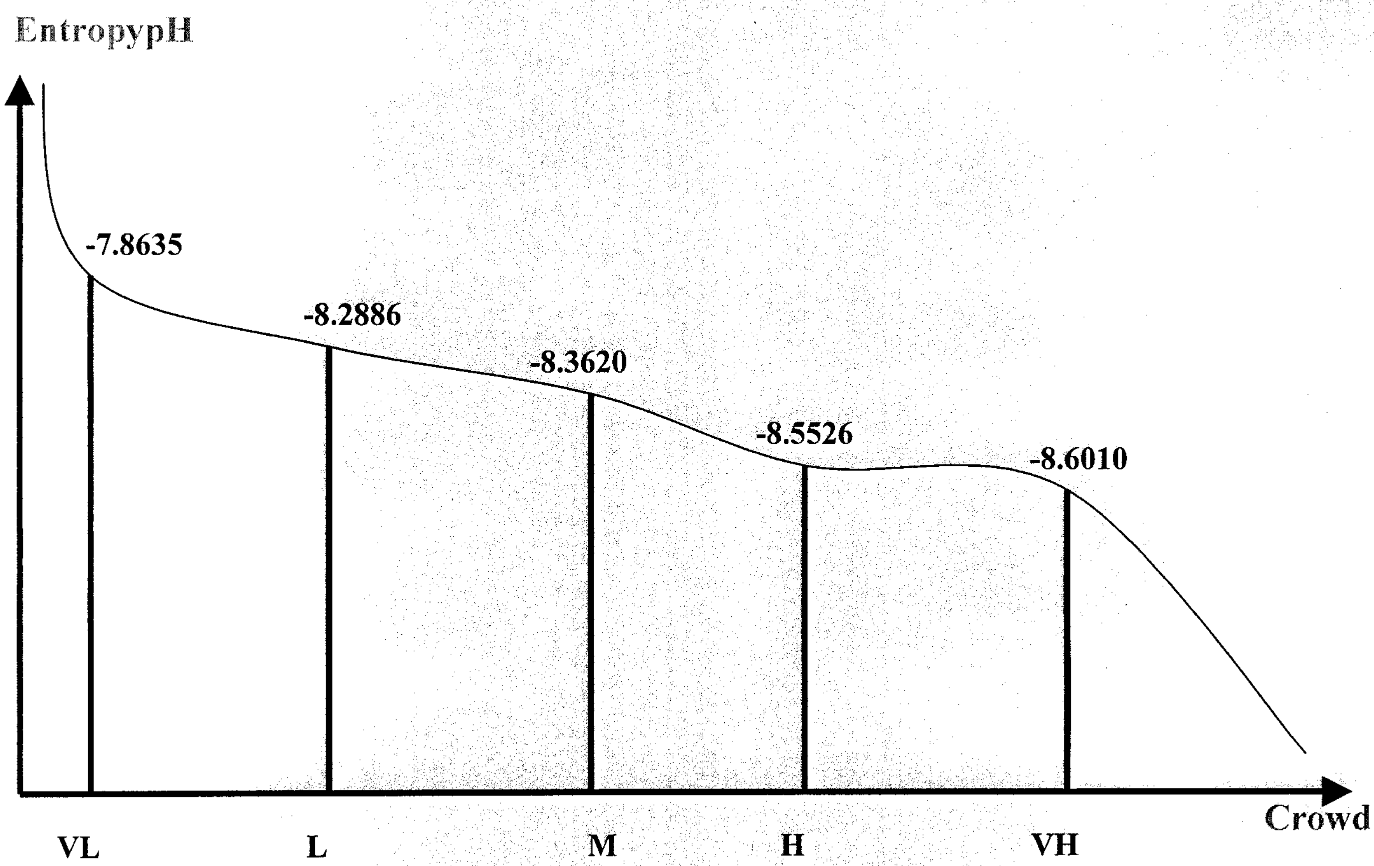

EnergeypLD
7.6132e-004
4.8974e-004
3.5102e-004
2.4654e-004
2.4600e-004
VL
L
M
H
VH
Crowd

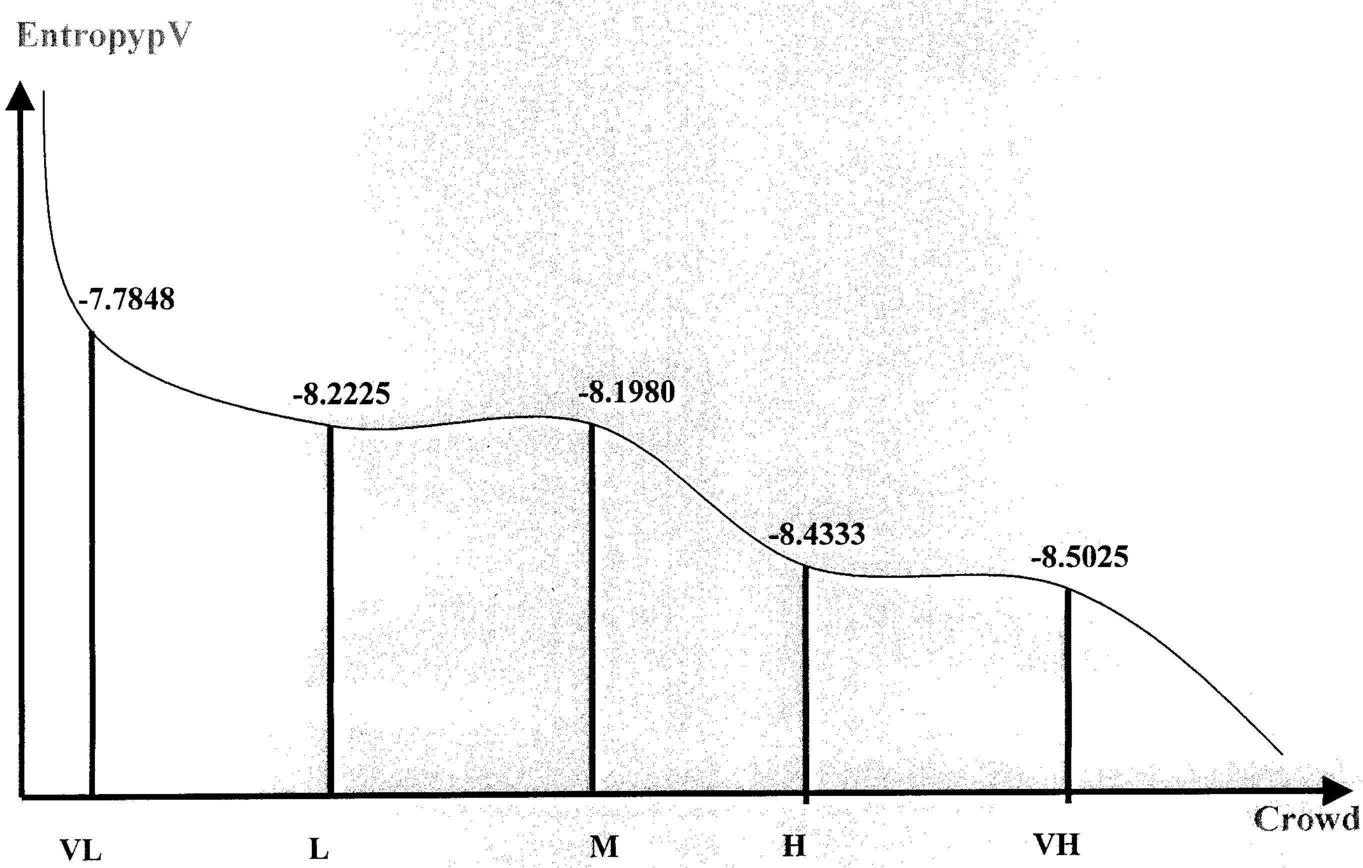

UniformitypH
0.0576
0.0443
0.0420
0.0315
0.0278
Crowd
VL
L
M
H
VH

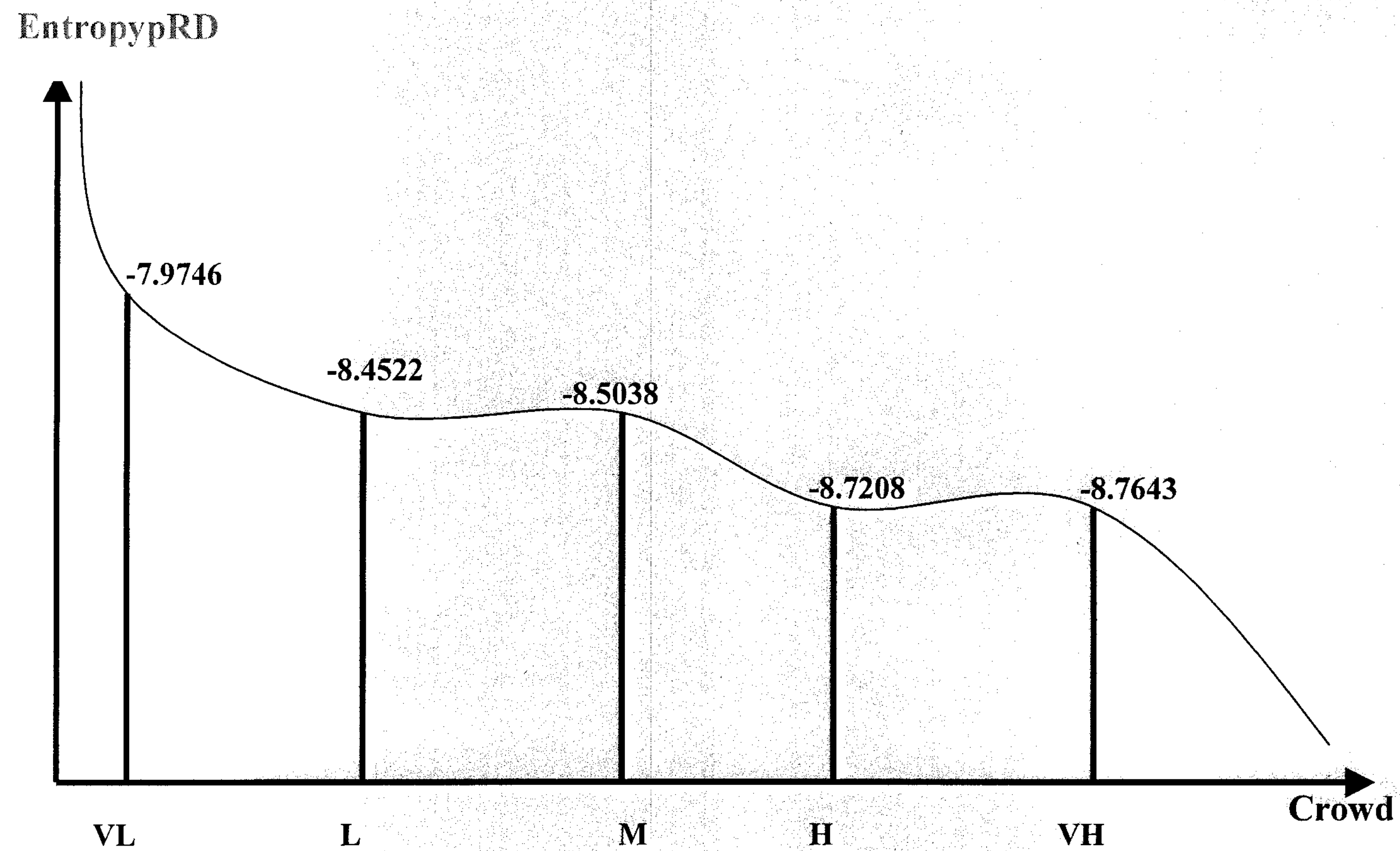

UniformitypV
0.0657
0.0486
0.0536
0.0396
0.0373
Crowd
VL
L
M
H
VH

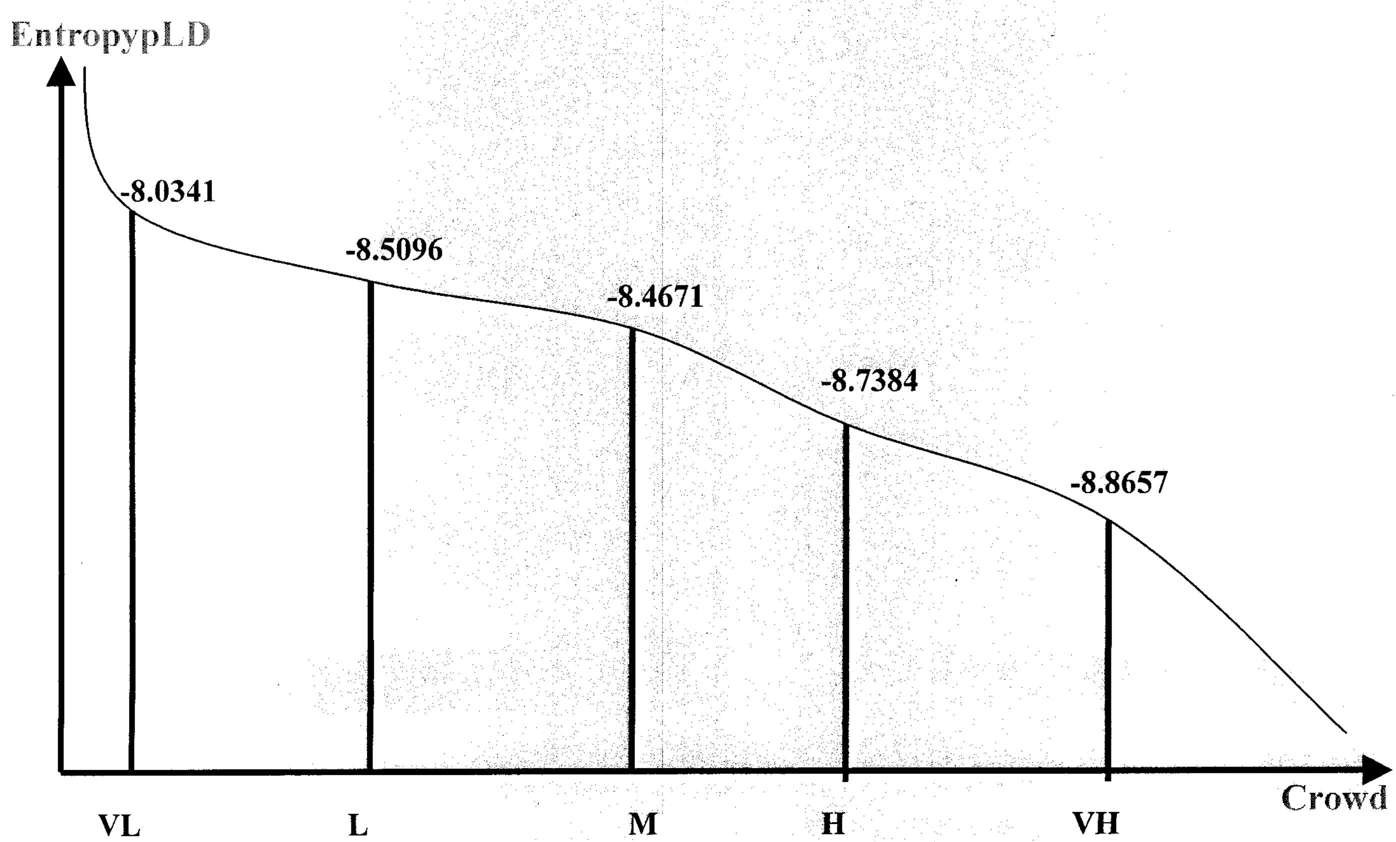

UniformitypRD
0.0527
0.0340
0.0325
0.0258
0.0252
VL
L
M
H
VH
Crowd


UniformitypLD
0.0495
0.0300
0.0336
0.0243
0.0255
VL
L
M
H
VH
Crowd


EntropypH
-7.8635
-8.2886
-8.3620
-8.5526
-8.6010
Crowd
VL
L
M
H
VH

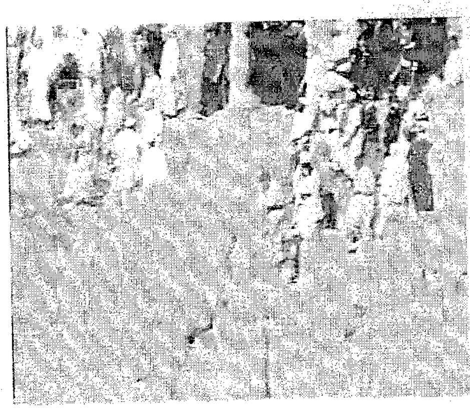

EntropypV
-7.7848
-8.2225
-8.1980
-8.4333
-8.5025
Crowd
VL
L
M
H
VH


EntropypRD
-7.9746
-8.4522
-8.5038
-8.7208
-8.7643
VL
L
M
H
VH
Crowd


EntropypLD
-8.0341
-8.5096
-8.4671
-8.7384
-8.8657
VL
L
M
H
VH
Crowd

Crowd density estimation Results

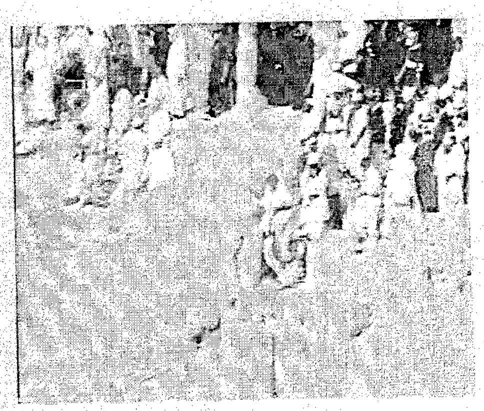
1.1- Very Low.



Actual=59
Estimated=59
%ERROR=0



Actual=65
Estimated=65
%ERROR=0



Actual=68
Estimated=68
%ERROR=0

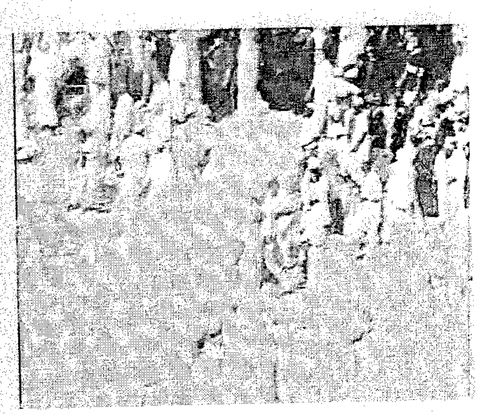
.2- Very Low.



Actual=70
Estimated=69
%ERROR=1.428



Actual=72
Estimated=71
%ERROR=1.358



Actual=73
Estimated=72
%ERROR=1.369

2.1- Low.



Actual=88
Estimated=95
%ERROR=7.95455



Actual=97
Estimated=95
%ERROR=2.06



Actual=91
Estimated=95
%ERROR=4.39

2.2- Low.



Actual=100
Estimated=95
%ERROR=5

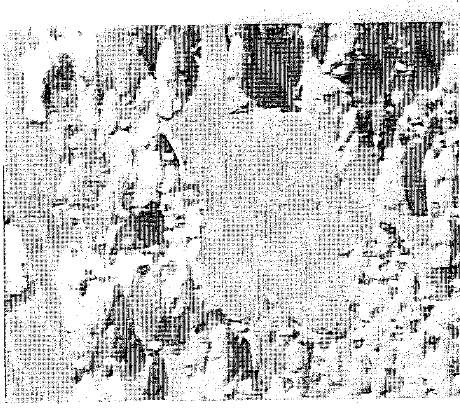


Actual=102
Estimated=117
%ERROR=15.1961



Actual=106
Estimated=117
%ERROR=10.8491

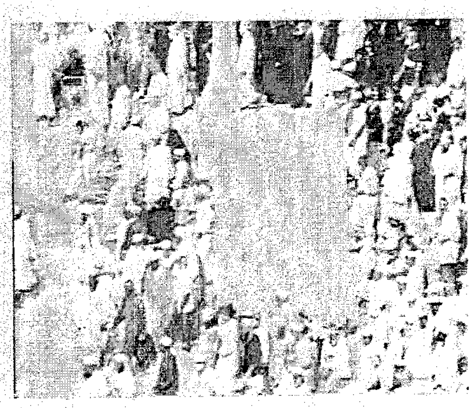
3.1-Medium



Actual=116
Estimated=117
%ERROR=0.862

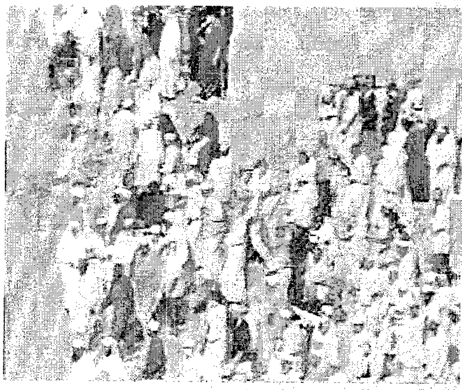


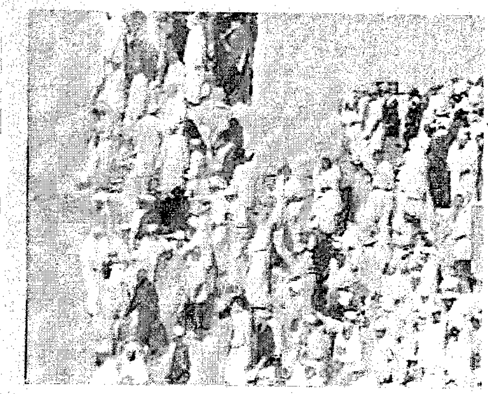
Actual=117
Estimated=117
%ERROR=0



Actual=119
Estimated=117
%ERROR=1.68

3.2-Medium





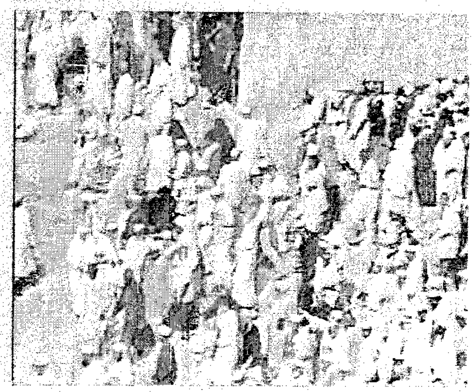
Actual=117
Estimated=117
%ERROR=0

Actual=115
Estimated=117
%ERROR=1.7

Actual=119
Estimated=117
%ERROR=1.6

4.1- High.





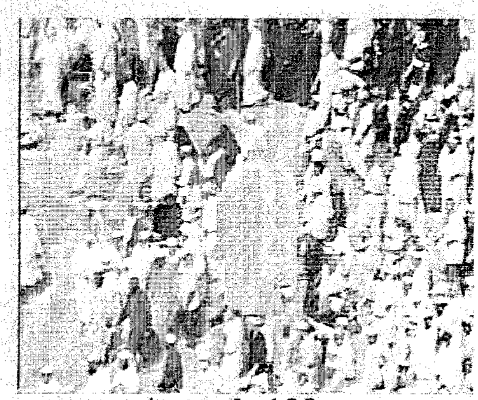
Actual=126
Estimated=126
%ERROR=0

Actual=127
Estimated=128
%ERROR=0.787

Actual=128
Estimated=129
%ERROR=0.781

4.2- High.





Actual=129
Estimated=130
%ERROR=0.775

Actual=132
Estimated=131
%ERROR=0.757

Actual=139
Estimated=131
%ERROR=5.755

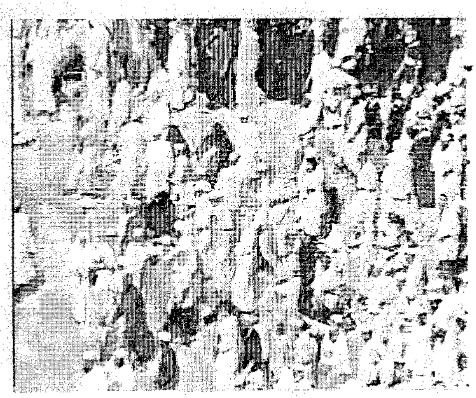
5.1- Very High.



Actual=142
Estimated=132
%ERROR=7.0422

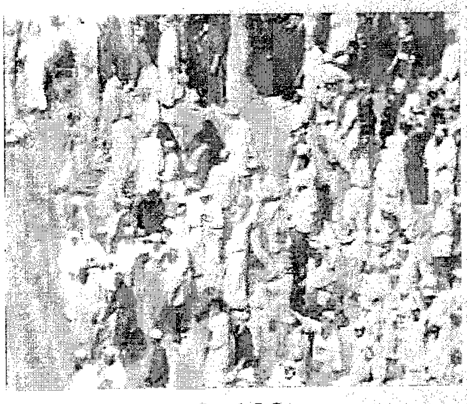


Actual=142
Estimated=133
%ERROR=6.33



Actual=140
Estimated=132
%ERROR=5.714

5.2- Very High.



Actual=139
Estimated=131
%ERROR=5.755



Actual=14
Estimated=132
%ERROR=6.382



Actual=143
Estimated=133
%ERROR=6.99

%Eerror=((Actual-Estimated) / Actual)*100

%ERROR	Actual	Estimated	IMAGE
٣,٦٣٦	٥٥	٥٧	١
١,٧٨٥	٥٦	٥٧	٢
1.785	٥٦	٥٧	٣
٠	٥٩	٥٩	٤
1.66	٦٠	٦١	٥
0	٦٥	65	٦
0	68	68	٧
1.428	٧٠	٦٩	٨
1.358	٧٢	٧١	٩
1.369	73	72	١٠
١,٣٥١	٧٤	٧٣	١١
2.666	٧٥	٧٣	١٢
1.351	٧٤	٧٣	١٣
4	٧٥	٧٢	١٤
2.666	٧٥	73	١٥
2.666	٧٥	73	١٦
7.792	٧٨	٧٢	١٧
48.4375	٦٤	٩٥	١٨
19.7	٧٦	٦١	١٩
20	٩٠	٧٢	٢٠
21.7949	٧٨	٩٥	٢١
20.2532	٧٩	٩٥	٢٢
18.75	٨٠	٩٥	٢٣
15.8537	٨٢	٩٥	٢٤
17.284	٨١	٩٥	٢٥
17.284	٨١	٩٥	٢٦
14.4578	٨٣	٩٥	٢٧
14.4578	٨٣	٩٥	٢٨
5.55556	٩٠	٩٥	٢٩
7.95455	٨٨	٩٥	٣٠
10.4651	٨٦	٩٥	٣١
7.95455	٨٨	٩٥	٣٢
2.06	٩٧	٩٥	٣٣
4.39	٩١	٩٥	٣٤
١٨,١٨	٩٩	١١٧	٣٥
23.157	٩٥	١١٧	٣٦
18.18	٩٩	١١٧	٣٧
5	١٠٠	٩٥	٣٨
15.1961	١٠٢	١١٧,٥	٣٩
10.8491	١٠٦	١١٧,٥	٤٠
3.9823	١١٣	١١٧,٥	٤١
0.862	١١٦	١١٧	٤٢
٠	١١٧	١١٧	٤٣
1.68	١١٩	١١٧	٤٤
3.305	١٢١	١١٧	٤٥
4.098	١٢٢	١١٧	٤٦
5.645	١٢٤	١١٧	٤٧

6.4	١٢٥	١١٧	٤٨
7.14	١٢٦	١١٧	٤٩
6.4	١٢٥	١١٧	٥٠
2.6	١١٤	١١٧	٥١
٠	١١٧	١١٧	٥٢
1.7	١١٥	١١٧	٥٣
2.6	١١٤	١١٧	٥٤
1.6	١١٩	١١٧	٥٥
2.5	١٢٠	١١٧	٥٦
2.5	١٢٠	١١٧	٥٧
3.305	١٢١	١١٧	٥٨
3.25	١٢٣	١١٧	٥٩
6.4	١٢٥	١١٧	٦٠
0	١٢٦	١٢٦	٦١
0.787	١٢٧	١٢٨	٦٢
0.781	١٢٨	١٢٩	٦٣
0.775	١٢٩	130	٦٤
0.757	١٣٢	١٣١	٦٥
5.755	١٣٩	131	٦٦
5.755	١٣٩	١٣١	٦٧
10	١٣٠	١١٧	٦٨
9.92	١٣١	١١٨	٦٩
3.0075	١٣٣	١٢٩	٧٠
2.985	١٣٤	١٣٠	٧١
٢,٩٦	١٣٥	١٣١	٧٢
3.759	١٣٣	١٢٨	٧٣
4.379	١٣٧	١٣١	٧٤
6.428	١٤٠	١٣١	٧٥
5.755	١٣٩	١٣١	٧٦
4.379	١٣٧	١٣١	٧٧
6.428	١٤٠	١٣١	٧٨
5.755	١٣٩	١٣١	٧٩
7.315282	١٤٢	١٣٢	٨٠
7.638	١٤٤	١٣٣	٨١
7.0422	١٤٢	١٣٢	٨٢
7.0422	١٤٢	١٣٢	٨٣
6.993	١٤٣	133	٨٤
6.33	١٤٢	١٣٣	٨٥
6.33	١٤٢	١٣٣	٨٦
6.33	١٤٢	١٣٣	٨٧
6.33	١٤٢	١٣٣	٨٨
6.33	١٤٢	١٣٣	٨٩
6.33	١٤٢	١٣٣	٩٠
6.33	١٤٢	١٣٣	٩١
6.33	١٤٢	١٣٣	٩٢
6.33	١٤٢	١٣٣	٩٣
6.33	١٤٢	١٣٢	٩٤
5.714	١٤٠	١٣٢	٩٥

5.755	١٣٩	١٣١	٩٦
5.714	١٤٠	١٣٢	٩٧
6.382	١٤١	١٣٢	٩٨
6.33	١٤٢	١٣٢	٩٩
6.99	١٤٣	١٣٣	١٠٠

SUGGESTED HARDWARE AND SOFTWARE DEVELOPMENT SYSTEM

Fig (6) shows suggested machine vision system with Lab VIEW real time. A digital CCD camera is suggested with the appropriate digital camera image acquisition NI 1424 - via the video-out port on the PXI controller.

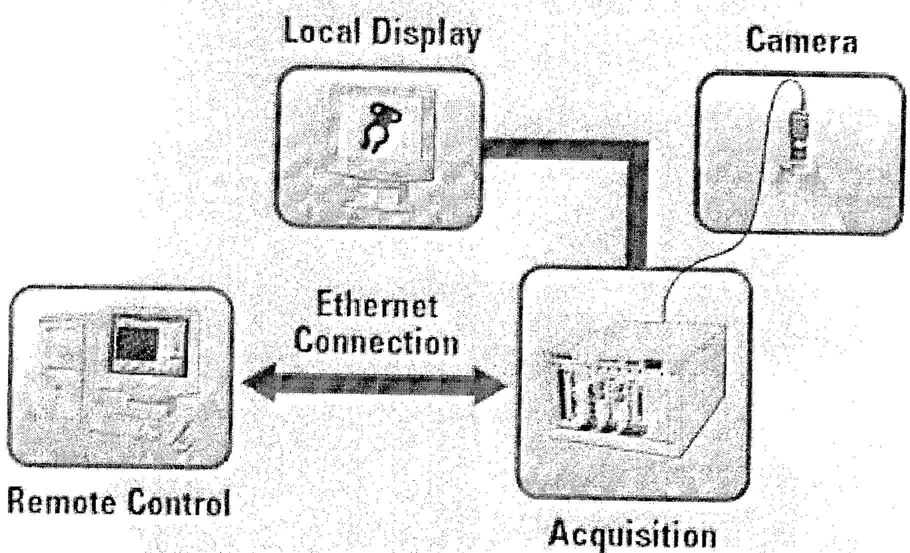


Fig (6): Real-Time Vision Development System

The implementation of the system based on the above suggested hardware and software depends on the progression of the project supported by "The custodian of the two Holly Mosques Institute for Hajj Research.".

7. CONCLUSIONS AND FUTURE WORKS

This project suggested SCADA system for monitoring surveillance and control the pedestrians in the holy sites. The survey of possible algorithms for automatic crowd estimation is given, as well as, the selection of the appropriate one. The model of "Jamrat" bridge is mentioned with the result of the necessity of closed loop control system. The implementation of the proposed system is the future work and will be given later on.

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